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NOTICE

The Agricultural Journal of S. Rhodesia

is issued by the Department of Agriculture, and can be obtained upon application to the Editor. The Annual Subscription, which must be paid in advance, is 5/-, and payment may be made by any means other than by stamps.

A 10/- note will cover the subscription for two years.

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Date,........................19.....

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Department of Agriculture,
Salisbury.

Please enrol me as a subscriber to the "Rhodesia Agricultural Journal" for one year from....................................., 19......, *for which I enclose*...

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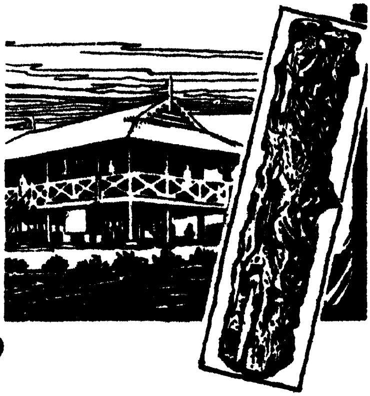
Are your timbers being eaten by White Ants?



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THE RHODESIA

Agricultural Journal

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(Assisted by the Staff of the Agricultural Department).

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Committee of Enquiry into the Economic Position of the Agricultural Industry.—The following meetings have been arranged for January and February, 1934:—

January 3rd	Macheke Hotel.
,, 4th	Umtali.
,, 9th	Sinoia.
,, 12th	Salisbury.
,, 16th	Gatooma.
,, 17th-18th	Gwelo.
,, 19th	Fort Victoria.
,, 20th	Umvuma.
,, 29th-31st	Bulawayo.
February 1st	Plumtree.

All those desirous of giving evidence are requested to communicate with the Secretary, Box 373, Salisbury, as early as possible.

Written statements of evidence will be welcomed in the case of persons unable to attend any of the sittings of the Committee.

The meeting at Salisbury will be held at Cecil Buildings. In the case of other centres, with the exception of Macheke, the places of meeting will be arranged by the local Magistrates.

Wheat Exhibition at Umvuma.—The fourth Annual Wheat Exhibition held at Umvuma on December 8th was a very successful one. Over eighty exhibits were staged, and districts which have not previously been represented, *viz.*, Umtali, Melsetter and Fort Victoria, competed on this occasion. Owing to the unfavourable season the grain exhibits on the whole were not up to last year's standard, and some were not so well prepared as they might have been. The bread section was remarkably good, and it is hoped that each year this feature will become more popular, particularly when some of the new strains of wheat, now in the experimental stage, are released for general production.

The Rhodesia Milling and Manufacturing Company staged a most attractive display of their products which attracted a good deal of attention and surprise, as very few people were aware that such a variety of articles were produced in the Colony.

A meeting of the Executive Committee of the Wheat Growers' Association was held in the morning and was attended by the Hon. the Minister of Agriculture and the Director of Agriculture.

The Exhibition was opened at 2.30 p.m. by the Hon. C. S. Jobling, Minister of Agriculture, and the prizes were presented by Mrs. Jobling during the dance which was given in the evening.

As on previous occasions a number of valuable prizes were given by firms supplying agricultural machinery and fertilisers, and by a number of private individuals, including Lieut.-Col. Guest and the Hon. C. S. Jobling. This year the value of the prizes exceeded one hundred pounds.

Christmas Display of Chilled Beef.—Dr. D. G. Haylett, Director of the Matopo Estate, calls attention to an article on Stall-fed Chillers for the Christmas Market, which appears elsewhere in this issue. In submitting the article he writes:—

"The development of agriculture in Southern Rhodesia, in common with all the African States south of the Equator, is dependent ultimately on livestock farming. World conditions during the last few years have made this viewpoint increasingly more obvious for many reasons. And a series of circumstances have arisen resulting in the birth of a Chilled Meat Industry giving promise for the future prosperity of cattle farming in Southern Rhodesia. Among the many factors connected with this new industry is also the question of marketing crop products through the animal body.

"A substantial beginning in the export of grass-fed chillers has already been made which reflects great credit on all concerned. But from the recent observations of the Senior Animal Husbandry Officer it would appear that the requirements of the overseas chilled meat trade imply that a period of stall-feeding will be necessary, at least at certain times of the year.

"In July last arrangements were made between the Rhodesian Export and Cold Storage Co. and the Matopo School of Agriculture to feed co-operatively a parcel of steers for the overseas Christmas market.

"The main object of the trial was to feed and export a selected uniform parcel of 100 prime stall-fed chillers for special display on the Christmas market at Smithfield. This display would serve to advertise Rhodesian chilled beef and would at the same time test the reception of the market for stall-fed cattle. The final report on the actual marketing of the parcel will not be available until after Christmas. The data on the feeding and management of the feeders is presented in the article appearing elsewhere in this issue. The details are fully discussed and may prove a useful guide to those who are contemplating feeding next year.

"Of particular interest is the question of costs. It must be obvious to any experienced farmer that such factors as the cost of feeders, price of feed, quantity of feeds available and the ability of the individual feeder are so variable that it would be futile to attempt to give any definite figure which would be generally applicable. However, all the relevant data, such as the amount of feed consumed, gains in weight, valuations of animals before and after feeding, have been presented. From these figures it should be relatively simple for any farmer to arrive at a fair estimate as to what it would cost him to feed and what the probabilities would be of his making a profit out of feeding."

Export of Chilled Beef.—Cable advices from England are to the effect that the Christmas shipment of chilled beef from the Matopo School of Agriculture, described in our last issue, has sold for up to ½d. per lb. below Argentine chilled beef, and touched 6d. per lb. for hinds.

A full report of this shipment is still awaited, and will appear in next month's *Journal*. The preliminary information is most encouraging, as it indicates that the ordinary run of good ranch bullocks properly finished can sell well at Smithfield and are welcomed by the trade.

The prices realised for grass-fed chillers during the last month have been below the average. This has partly been due to unseasonable weather in England, and partly to the lower quality of the shipment which left towards the end of October, and early November. This emphasises again the necessity of supplementary feeding but does not detract from the fine achievement of the Rhodesian Export and Cold Storage Company in maintaining regular weekly shipments throughout the dry season despite adverse prices and a shortage of feed.

Export of Frozen Porkers.—During the course of December 100 porkers were selected for a trial shipment of Frozen Porkers to Smithfield.

There is at present a shortage of pigs of all description in the Colony, but more difficulty was experienced in getting together pigs of the right weight for slaughter in January than in finding porkers of a satisfactory quality for the shipment.

Pigs of the following breeds and crosses have been selected:—

Berkshire x Middle White.
Berkshire x Large Black.
Large White x Large Black.
Large Black.

Approximately half the pigs are receiving separated milk as a supplement to maize, and the remainder blood or meat meal, instead of separated milk. In all cases a general system of feeding laid down by this Department is being followed for the fattening of the pigs. If the present promising conditions continue and the pigs are delivered in the condition anticipated the experiment should provide a good deal of useful information for the future development of the trade.

It is hoped to export the pigs early in February.

Horticulturist on Leave.—Mr. G. W. Marshall, the Horticulturist of the Department, is at present on long leave at the Coast, and will return to duty in June next, in time for the planting and pruning season for fruit trees. Owing to financial considerations his post will not be filled during his absence, but urgent enquiries may be addressed to the Director for attention.

Tung-seed Meal not Suitable for Cattle-feed.—The Rowett Institute recently investigated the possibility of using the residual meal left after the expression or extraction of the oil from the tung-seed as cattle-feed. The meal was found to be fairly rich in protein and carbohydrates, but was definitely unpalatable to poultry, dairy cattle and pigs. It was found, too, that the meal contains some substance which is definitely harmful and causes severe irritation, although not more than 1 per cent. of oil remained in the meal.

One cow in milk was given a mixture containing 10 per cent. of tung-seed meal in the concentrates, but this caused scouring, and the second day the milk yield was down half a gallon and the cow refused to touch the mixture again. There is not the slightest doubt that tung-seed meal is quite unsuitable for feeding to livestock, even in very small amounts.

Samples of Tung-oil from Salisbury.—Some months ago two samples of tung-oil fruits grown in Salisbury gardens were submitted to Kew by the Chief Forest Officer for favour of report. These were referred to the Imperial Institute and a report has now been received which indicates that some of the fruits were somewhat small, but the number of nuts per fruit was high and the oil content quite up to the average. Oil was expressed from both samples, and although the refractive index was below the usual for plantation grown fruits, the oil compared favourably with the present-day market article.

Kino from Southern Rhodesia.—Kino is the name given to the resin-like dried sap obtained from an Indian tree closely related to our Mukwa or Blood-wood (*Pterocarpus angolensis*). It is not a resin such as is used in varnish, but contains a very high percentage of tannin and was formerly largely used in medicine as an astringent. A few months ago two samples were sent to London by the Chief Forest Officer for investigation. They were obtained from the Mtao Forest Reserve (1) and the Gwaai Forest Reserve (2), and a report has now been received from the Imperial Institute. The following extracts from the report are of particular interest:—

"The astringency of Sample No. 1, as indicated by its tannin content, was comparable with that of Malabar kino, and its appearance, characters and reactions are seen to show a general, though not entire, concordance with the requirements of the 1914 Edition of the British Pharmacopoeia for that material. The astringency of Sample No. 2 as indicated by its tannin content was slightly below the range for Malabar kino, and its inferior appearance would render the material less acceptable than Sample No. 1.

In view of the fact that both samples are from the same botanical source in Southern Rhodesia, it seems probable that the inferior appearance of Sample No. 2 may be due to lack of care in preparation. In the case of *P. Marsupium*, the Indian species, it is necessary to boil the exuded juice before evaporation, to destroy the oxidase naturally present and thus prevent subsequent oxidation of the kino-tannic acid, a change which gradually imparts a dull appearance to the product. It is probable that this precaution would be justified in the case of the present material. Portions of the samples were submitted to wholesale druggists in London, who furnished the following report:—

"We have been interested to examine the two samples of kino from Southern Rhodesia.

"It seems to us that the samples compare favourably in appearance with the Malabar kino, although as you will have observed the colour is somewhat lighter, being a reddish brown instead of a reddish black.

"The present value of Malabar kino ranges from 9d. to 1s. per lb. according to quality, and we can think of no reason why kino from Southern Rhodesia could not command the same price.

"We believe it is true to say that the demand for kino is now much smaller than in the past. It is certainly true that the demand for kino for medicinal purposes is very much less than it used to be."

TOBACCO GROWERS!

Important Notice.

THE "KROMNEK" DISEASE OF TOBACCO.

It is necessary to call the attention of all tobacco growers to the recent appearance in the Colony of what is apparently the virus disease known, in the East Cape Province, as "Kromnek," or "Kat River Wilt." Several specimens just received in the Plant Pathology laboratory bear symptoms identical with those described by Dr. E. S. Moore* in the Union, but no further information regarding distribution and mode of dissemination in Rhodesia is to hand at the time of going to press.

As "Kromnek" is regarded as a serious menace to the tobacco industry, the co-operation of all farmers is sought in sending reports (accompanied by specimens) of its occurrence to the office of the Plant Pathologist, Department of Agriculture, Salisbury.

The symptoms as they have appeared on flue cured tobacco one month after planting out are as follows:—

The terminal bud ceases to grow upwards whilst some of the lower leaves continue to enlarge, thus producing a sunken crown. The stems of larger plants have a peculiar twisted appearance and are somewhat flattened or fluted. The bud often bends over at right angles to the main axis carrying the uppermost young leaves with it. Where the disease is virulent a rot sets in at the base of the stem, causing a dark brown or black discoloration near the "collar" which extends to the pith, producing the effect known as "discing." Under these conditions a distinct wilt may occur.

Definite symptoms appear on the leaves. The growth of the midrib is first arrested, whilst the blade continues to expand, so that it becomes puckered and "fluted from the

*Moore, E. S., Sci. Bull. 123, Dept. of Agric., Union of S.A.

midrib outwards as though it had been pulled up on an elastic." A darkening and shrivelling of the midrib and veins often accompanies this condition, and secondary organisms may set up a rot of the entire leaf during wet weather.

Dr. Moore describes several other symptoms, particularly on Burley types of tobaccos, such as mottling of the young leaves, dark markings on the veins and "ring spotting" or "fern leaf" patterns on the leaves. "One-sided distortion of leaves is common" and "twisting may also occur, so that the under surface of the leaf faces upwards."

What is considered to be the same disease is reported by Dr. Moore from tomato, Stinkblaar (*Datura stramonium*), Apple of Peru (*Nicandra physaloides*), Wild Gooseberry (*Physalis minima*), Cape Gooseberry (*Physalis peruviana*) and several other commen weeds and cultivated plants. It is possible that it may occur in Rhodesia on Kaffir Spinach (*Amarantus græcizans*).

The disease is similar in many respects to Leaf Curl of tobacco, and the Department of Agriculture is most anxious to ascertain immediately the distribution of "Kromnek" in order that steps may be taken to prevent an epidemic.

Poisoning by Arsenic.

WARNING TO STOCK OWNERS.

The following timely notes have been supplied by the Veterinary Department, and should be noted by all farmers.

Arsenic is the principle constituent of all tick and locust destroying preparations and is thus widely distributed throughout the Colony.

It is an irritant poison and causes, when taken internally, an intense inflammation of the digestive tract which usually proves fatal.

Recent misadventures in the Colony, resulting in heavy mortality in cattle, emphasise the need of this article, which, it is hoped, will serve as a warning to stockowners.

The writer has on many occasions been called upon to investigate unaccountable sickness and mortality in stock. It might perhaps serve to illustrate the dangerous nature of arsenic if some of the experiences met with are related.

Some years ago six valuable bulls which were being prepared for Show purposes were reported as having suddenly developed alarming signs of illness. An inspection indicated that the illness was due to some irritant poison, probably arsenic. The animals, being stall fed, it was obvious that this must have been taken with the food. It was ascertained that there had been no recent change in the diet, but that a fresh lot of oil cake had been opened that morning. An examination of this showed that the sack had been in contact with some sticky fluid.

A chemical analysis of a sample of the cake taken from the top portion of the bag showed arsenic to be present in considerable quantity. Subsequent investigation showed that

a leaky drum of cattle dip had been placed on the top of the sack of cake. Had the contents of the latter been, say, mealie meal, flour, or any other article used for human consumption, the results might have proved too dreadful to contemplate; in fact, it was computed at the time that the small sample of cake forwarded for analysis contained sufficient arsenic to prove fatal to at least ten human beings. In this instance, it must be added, that circumstances pointed to the fact that the food had become contaminated previous to its arrival on the farm.

Mortality in a number of donkeys was investigated. A diagnosis of arsenical poisoning was given, which was received with much doubt by the owner. He stated that no arsenic had been used in the stables or the yards for several years.

It was subsequently found that about two years previously a package of sheep dip powder had fallen from a shelf in the store room on to the floor. An inspection showed that the powder had lodged in the crevices of the flooring boards. This contaminated some hay which was fed to the donkeys with dire results.

Recently mortality in cattle occurred under the following circumstances:—A native servant had been in the habit, on instruction from his employer, of adding a quantity of a medicinal proprietary fluid to the animals' feed. When the supply of this was finished he substituted a quantity of cattle dipping fluid. He innocently acted under the impression that all things that came out of a drum served the same purpose.

In many cases where mortality is found to be due to arsenic, the owner suspects that this has been administered maliciously. It is, however, traced generally to the failure of the owner, or his servant, to appreciate the dangerous nature of the article that he is handling.

It is not the intention to describe here the symptoms, *post-mortem* appearances, and treatment or arsenical poisoning, sufficient to say that prevention is better than cure, and that should the following precautions be observed, mortality from arsenical poisoning should be reduced to a minimum:—

1. Keep cattle dipping fluid or other arsenical preparations in a separate store under lock and key.

2. Impress upon your servants its dangerous nature.

3. Supervise the mixing of the contents for the dipping tank personally, or satisfy yourself that the servant who is entrusted with this duty has sufficient intelligence.

4. See that your dipping tank and the immediate vicinity is safely secured from straying cattle.

5. Have the contents of the dipping tank tested periodically.

Gum Poles For Sale at Mtao Forest Reserve.

A limited quantity of gum poles is for sale at the Mtao Forest Reserve.

A small quantity is already cut, and a further quantity will be cut as orders are received.

Owing to the fact that the poles to be cut are thinnings only, the sizes are small. They would be suitable for scaffolding, building, telephone and wireless poles and small mining timber.

Prices are quoted below for the principal sizes, but a small quantity of larger sizes will be available, prices of which may be had on application.

	Diameter at Butt, over bark.					
Length:	1in.-2in.	2in.-3in.	3in.-4in.	4in.-5in.	5in.-6in.	6in.-7in.
6 feet ...	1d.	2d.	4d.	6d.	9d.	1/-
8 feet ...	1½d.	3d.	5d.	8d.	1/-	1/4
10 feet ...	2d.	4d.	6d.	10d.	1/3	1/8
12 feet ...		5d.	7d.	1/-	1/6	1/8
14 feet ...		6d.	8d.	1/2	1/9	2/4
16 feet ...		7d.	10d.	1/4	2/-	2/8
18 feet ...		8d.	1/-	1/6	2/3	3/-
20 feet ...		9d.	1/2	1/8	2/6	
22 feet ...			1/4	1/10	2/9	
24 feet ...			1/6	2/-	3/-	
26 feet ...			1/8	2/2	3/3	
28 feet ...			1/10	2/4	3/6	
30 feet ...			2/-	2/6	3/9	

TERMS.—Cash with order. Prices are F.O.R. FAIRFIELD SIDING.

Deduct 5% for delivery at plantation.

Orders will be dealt with in strict rotation.

Apply to the District Forest Officer, Mtao Forest Reserve, P.B. UMVUMA.

Stall Fed Chillers for the Overseas Christmas Market.

By C. A. Murray, M.Sc., Animal Husbandry Officer,
Matopo School of Agriculture and Experiment Station,
Rhodes Matopo Estate.

METHODS ADOPTED.

During the period August 1st to October 8th a total of 151 steers were received at the Institution for feeding. As the trial was not anticipated during the previous planting season sufficient feed was not available at the Institution. This was purchased from various sources by the Rhodesian Export and Cold Storage Co. and delivered at the Institution.

Feeding Pens and Equipment.—Feeding pens to accommodate 10 steers per pen, approximately 33 ft. by 45 ft. in size, were erected under some large Mimosa trees where a fair amount of natural shade was available. Four of the pens were not sufficiently shaded by the trees, and cheap shelters, made from native timber and old corrugated iron, had to be erected.

In each pen a hay rack and two troughs, one opposite the other, were fitted. The hay racks could be filled directly from a wagon. In the fattening of cattle sufficient trough space is essential, and in the pens approximately 4 ft. per steer were allowed, *i.e.*, two troughs of 20 ft. each per pen.

Before the steers arrived the pens were well bedded with old coarse grass, maize stalks, etc., to assist in the collection and accumulation of manure. Occasionally when it appeared necessary more bedding was added.

Steers.—These varied considerably as regards breeding, type and condition. All the steers, with the exception of 10 Herefords, were dehorned. These 10 horned steers, although

horn-tipped at the commencement of the trial, very forcibly demonstrated the necessity for dehorning commercial beef cattle. All the polled steers took readily to their feed, were quiet and docile, whereas the 10 horned steers were so nervous and afraid of each other that it took nearly two weeks before they took to their feed, and throughout the whole feeding period a few of the stronger animals monopolised the troughs while the others stood back too afraid to feed.

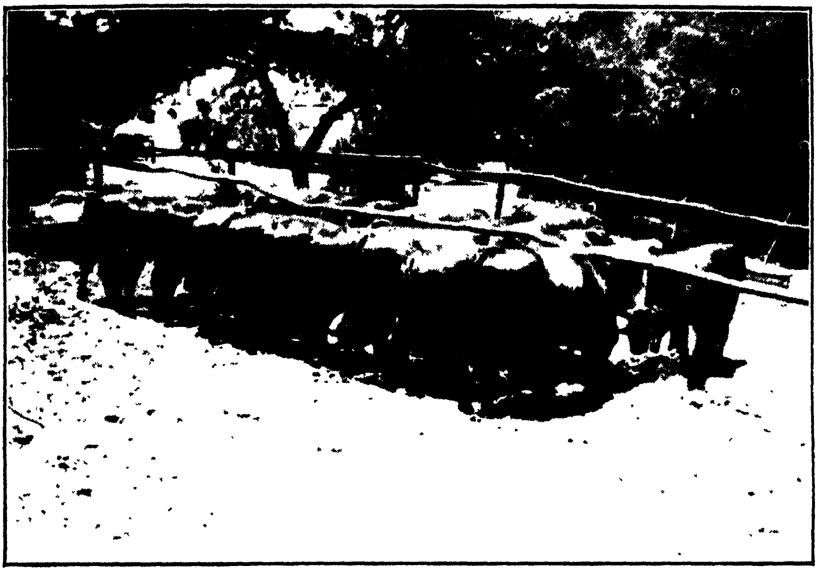
Feeding, Watering and General Management.—The steers were given as much hay as they could clean up and received silage and meal twice daily at 7 a.m. and 5 p.m.

In the economical fattening of cattle, good quality hay, preferably legume hay, and succulents are essential. Unfortunately, due to the fact that the trial was not anticipated during the previous planting season, and because of the bad season experienced, only a very limited amount of silage was available at the Institution, and good quality veld hay was unprocurable locally. The hay fed was of poor quality and at times caused digestive disturbances.

Because of the very limited amount of silage available, each steer received on the average only 3lbs. per day whereas 25 to 40 lbs. would have been a more normal allowance. This small amount of silage was given only for the purpose of keeping the animals loose and their digestive organs in good working order.

From the above it is clear that the roughage part of the ration was not satisfactory and was not conducive to economical gains.

The concentrates were weighed out to the steers twice daily and fed dry and *not* boiled, soaked or moistened. The usual practice was to put the silage and the meal in the troughs at the same time and to mix them slightly. The concentrates consisted of maize meal, n'youti meal, peanut meal, blood meal, bone meal and salt. Depending on the condition of the



Feeding silage and concentrates in the troughs

Feeding pens showing troughs and hay racks.

streers and the stage of fattening, the concentrates were mixed in such proportions that each steer received a daily ration of from 4 to 15 lbs. of maize meal (or equal parts of maize meal and n'youti meal), $\frac{1}{2}$ to $1\frac{1}{2}$ lbs. of peanut meal, $\frac{1}{8}$ to $\frac{1}{2}$ lb. of blood meal, 3 ozs. of bone meal and 1 oz. of salt. It should be pointed out here that blood meal was not an essential ingredient of the ration, but as the Company could supply this *ex* their works, a small amount of it was used, and some of the peanut meal which they had to buy was eliminated. It should be pointed out further, that, if good quality legume hay had been available, it would have been possible to eliminate all the peanut meal and blood meal from the ration. For the farmer this is very important, as it will eliminate the purchasing of expensive protein-rich concentrates and allow him to fatten his cattle on farm grown feeds only.

Water was not laid on to the pens, but once daily the steers were taken out for watering to a trough about 100 to 150 yards away. This also allowed a little useful exercise.

Throughout great care was taken to prevent the animals from being bruised when entering or leaving the pens.

It must be borne in mind that it was necessary to have all the steers finished as uniformly as possible at the conclusion of the trial. They were continually graded in the pens according to condition, upon which basis the feeding was adjusted. The lesser-finished steers were put together and fed more heavily than the better-finished ones in order to get them all to reach the same degree of finish at the conclusion of the trial. Under ordinary circumstances the animals would have been slaughtered as soon as they reached the requisite finish. This fact resulted in less efficiency than would have been possible had the feeding been done purely on commercial lines.

DISCUSSION OF RESULTS.

The 151 steers were divided into four distinct lots and weight and feed records were kept separately for the four lots of cattle.

Table 1.—Detailed data of the four lots of steers.

	LOT I.			LOT II.			LOT III.			LOT IV.		
No. of steers in lot	30			70			20			31		
Average age (approx.)	4-5			4-5			5			5		
Breeding of steers	Sussex and Devon grades			Grade A. Angus, grade Hereford and grade Sussex.			High grade Aberdeen Angus.			Preponderance of Africander blood.		
No. of days fed	100			89			81			33		
Aver. initial weight per steer	958 lbs.			1,008 lbs.			1.009 lbs.			1,063 lbs.		
Aver. final weight per steer ...	1,167 ,,			1,250 ,,			1,230 ,,			1,134 ,,		
Aver. total gain per steer... ...	209 ,,			242 ,,			221 ,,			71 ,,		
Aver. daily gain per steer ...	2.1 ,,			2.7 ,,			2.7 ,,			2.2 ,,		
Aver. cold dressed weight... ...	634 ,,			689 ,,			684 ,,			611 ,,		
	Average per steer per day.	Average total per steer.	Total per lot.	Average per steer per day.	Average total per steer.	Total per lot.	Average per steer per day.	Average total per steer.	Total per lot.	Average per steer per day.	Average total per steer.	Total per lot.
FEED CONSUMPTION—												
Roughage—Veld hay ... ... lbs.	19.2	1,924	57,730	18.1	1,615	113,032	16.1	1,307	26,133	11.1	366	11,370
Maize silage ,,	3.2	318	9.540	3.0	271	18,950	2.8	228	4,560	1.8	59	1,829
Concentrates—Maize meal ,,	9.0	900	27,008	10.9	696	67.836	5.7	463	9,251	10.5	346	10.714
Nyouti meal ,,	.76	76	2,291	—	—	—	5.6	455	9,091	—	—	—
Peanut meal ,,	1.0	100	2,988	1.1	101	7,068	1.2	98	1,965	.9	31	963
Blood meal ,,	.33	33	993	.38	32	2,356	.4	33	655	.3	10	321
Bone meal ,,	.13	13	397	.15	13	944	.16	13	262	.13	4	128
Salt ,,	.07	7	197	07	6	448	.08	7	131	.06	2	64
Total Concs. ,,	11.3	1,129	33,874	12.6	1,124	78,652	13.2	1,068	21,355	11.9	393	12,190
Pounds hay per 100 lbs. gain in liveweight	921			667			591			516		
Pounds silage per 100 lbs. gain in liveweight...	152			112			103			83		
Pounds concentrates per 100 lbs. gain in liveweight... ...	540			464			483			554		

Lot I.—The 30 steers in this group showed a preponderance of Sussex and Devon blood. For their age they were not too well developed. At the commencement of the trial they were in medium condition and were valued at £3 each.([1]) During the 100 day feeding period they gained on the average 209 lbs. per steer, *i.e.*, an average daily gain of 2.1 lbs. per steer. This was satisfactory. The average cold dressed weight (*i.e.*, hot dressed weight less 3%) per steer was 634 lbs.

At the conclusion of the trial the Cold Storage Company was offering 22/- per 100 lbs. cold dressed weight.* The steers would, therefore, have realised £6 19s. 6d. each. This leaves a margin (actual realisation less initial cost) of £3 19s. 6d. per steer to cover costs of feeding, etc.

Detailed feed consumption figures are given in Table I. The average total feed consumed per steer for the entire feeding period was 1,924 lbs. of hay, 318 lbs. of silage and 1,129 lbs. of concentrates. The amounts of hay, silage and concentrates consumed to produce 100 lbs. of gain in live-weight were 921 lbs., 152 lbs. and 540 lbs. respectively.

Lot II.—This lot consisted of 70 grade Aberdeen Angus, grade Hereford and grade Sussex steers. The Angus and Sussex steers showed $\frac{1}{8}$ to $\frac{1}{4}$ Africander blood. The steers were of good type, fairly well fleshed and in good medium condition at the commencement of the trial and were valued at £3 12s. 6d. each.

During the feeding period of 89 days they gained on the average 242 lbs. per steer, which is equivalent to an average daily gain of 2.7 lbs. per steer. These gains should be considered very satisfactory.

The average cold dressed weight per steer was 689 lbs., and at 22s. per 100 lbs. the average value per steer was £7 11s. 6d., thus leaving a margin of £3 19s. to cover feeding and other costs.

([1]) **At the commencement of the trial all the steers were valued jointly by the Animal Husbandry Officer of this Institution and the buyer of the Rhodesian Export and Cold Storage Co.**

***Inclusive of $\frac{1}{4}$d. per lb. dressed weight special bounty for "stall-fed cattle."**

During the whole feeding period each steer consumed on the average 1,615 lbs. of hay, 271 lbs. of silage and 1,124 lbs. of concentrates. The amounts of hay, silage and concentrates required to produce 100 lbs. of gain in liveweight were 667 lbs., 112 lbs., and 464 lbs. respectively. It appears, therefore, that these steers made more economical gains than the Lot I. steers. The better type and better condition at the commencement of the trial was most likely responsible for this.

Lot III.—The twenty steers in this group were high grade Aberdeen Angus of very good conformation and beef type. They were well fleshed, in good medium condition, and valued at £4 each at the commencement of the trial.

It should be pointed out that the steers in this group received a ration exactly similar to that given to the steers in Lot II., with the exception that half the maize meal was replaced with n'youti meal.

The total gain per steer during the feeding period of 81 days was 221 lbs. and the average daily gain 2.7 lbs. Lots II. and III., therefore, made similar gains.

The average cold dressed weight per steer was 684 lbs. At 22s. per 100 lbs. the average value per steer at the conclusion of the trial was £7 10s. 6d., and the margin to cover feeding costs, etc., £3 10s. 6d.

The average total feed consumed per steer was 1,307 lbs. of hay, 228 lbs. of silage, and 1,068 lbs. of concentrates, and the feed required to produce 100 lbs. of gain in liveweight amounted to 591 lbs. of hay, 103 lbs. of silage and 483 lbs. of concentrates. As regard economy of gain the steers in Lot III. were on a par with the Lot II. steers and lower than those in Lot I.

From the above figures it appears that n'youti meal can successfully replace 50% of the maize meal in the ration for fattening steers. This is of practical importance to farmers in areas where maize cannot be grown successfully and where n'youti can be grown by the farmer or purchased or traded from the natives at a figure below the ordinary market price of maize.

Lot IV.—The object here was to see whether the ordinary type of ranching cattle could be "topped off" successfully.

This lot, consisting of 31 steers is, therefore, of particular interest. They were of an ordinary ranching type of which the Colony can produce many thousands. They were not very strictly selected as feeders as the idea was to get a sample of steers representative of the ordinary run of ranching cattle. On the whole they showed little "breeding," being mostly first cross progeny by Africander and Shorthorn bulls out of native cows. Most resembled the Africander. At the commencement of the trial they were in good condition, and would have passed as fair chillers. They had actually been bought by the Company as chillers at £4 10s. each, and this figure is taken as their initial value.

These steers during a 33 day period of heavy feeding (topping) gained on the average 71 lbs. per steer, *i.e.*, an average daily gain of 2.2 lbs. per steer. For the type of steer fed and the short feeding period, the gains were very satisfactory.

The average cold dressed weight was 611 lbs. per steer. At 22s. per 100 lbs. the steers would have realised £6 14s. each, thus leaving a margin of £2 4s. to cover feeding costs, etc., over the very short period of 33 days.

The total feed consumed per steer was 366 lbs. of hay, 59 lbs. of silage, and 393 lbs. of concentrates, and the requirements per 100 lbs. gain in liveweight were 516 lbs. of hay, 83 lbs. of silage and 554 lbs. of concentrates. In this case the amount of concentrates required to produce 100 lbs. gain in liveweight was higher than for Lots II. and III., but this was due to the fact that 3 of the 31 steers turned out bad doers.

The results from this particular lot of steers indicate that it is possible to "top off" during a short feeding period, the ordinary type of ranchiing steers of rather mixed breeding, provided, of course, they are in good condition at the commencement of the feeding period.

As pointed out previously, owing to the fact that most of the feed, including veld hay, was purchased off the farm, no purpose would be served in presenting the actual costs involved in the feeding operations in order to determine whether or not feeding is profitable. A figure arrived at on this basis would be inapplicable under a different set of conditions.

The variables entering into the production costs of feed alone will differ from farm to farm depending on locality, rainfall, fertility and managerial ability of the farmer. The futility of attempting to state specifically what profit can be made of feeding is obvious when one realises the variable nature of the factors involved. Thus the age, type, condition, value and suitability of feeders; the quality, type, cost of production of farm grown feeds; the cost of feeds not available on the farm; transportation charges; managerial ability of the farmer in selecting feeders, feeding, handling of labour and numerous other factors must be given due consideration. Of more practical significance are the data in Table I. showing the amounts of hay, silage and concentrates required to produce 100 lbs. of gain in liveweight. These figures will enable the farmer to make a fairly accurate estimate of feeding costs when the steers used and the rations fed are more or less similar to those used in this particular trial. Of further interest is the difference between the value of the steers before and after feeding. The difference between these two figures gives some indication of the margin available to cover feeding costs. In this respect the data indicate that a low initial cost of the feeder is a very important factor in the economical and profitable fattening of steers.

In attempting to arrive at the probable profitableness of feeding the value of the manure must be taken into consideration. In this particular trial approximately 100 tons of excellent manure were obtained from the 151 steers. The average farm value of manure is usually taken at 10s. per ton. At this figure the value of the manure per steer for Lots I. II. III. and IV. was 8s. 6d., 7s. 6d., 6s. 6d. and 2s. 9d. respectively.

The fact should not be lost sight of that it would have been possible to reduce the feeding costs considerably if better quality hay and more silage had been available. It would not only have reduced the feed requirements per 100 lbs. gain in liveweight, but, if good quality legume hay had been available, it would have been possible to eliminate the two very expensive purchased concentrates, *viz.*, peanut meal and blood meal, and so reduced feeding costs still more. The desirability of growing as many feeds as possible on the farm is therefore obvious.

SUMMARY.

1. The method of feeding and general management of 151 stall fed steers fattened at the Matopo School of Agriculture in co-operation with the Rhodesian Export and Cold Storage Company has been described and discussed.

2. The main object of the trial was to stall-feed and export 100 selected carcasses as chillers for a special display on the Christmas Market at Smithfield advertising Rhodesian chilled beef.

3. Incidental to the main object of the trial data were obtained showing the gains and feed consumed.

4. While no attempt has been made to give a figure which will represent the cost of feeding for reasons stated, nevertheless it is suggested that from the data presented any individual farmer could obtain a measure of guidance as to the possibility of profitable feeding under his particular farming conditions.

5. The data show that "topping" steers already in good condition for a short period of time was more economical than feeding steers in medium condition at the commencement of the feeding period over a long period of time.

6. It is of interest to note that 50% of the maize portion of the ration can be replaced by n'youti without loss of efficiency.

7. The importance of a low initial cost of the feeders is clearly demonstrated.

MARKET REPORT.

Some little time still must elapse before the full details of the sale of this parcel at Smithfield are received. Cable information received indicates that the meat touched 6d. per lb. for hind quarters and sold at ½d. per lb. below Argentine chilled beef. This preliminary information is very encouraging.

ACKNOWLEDGEMENT.

Acknowledgement is made to the Chairman, Maize Control Board, for his assistance in supplying maize at a low cost for the feeding operations. Acknowledgement is also due to Mr. R. H. Greaves, Stockman, and Mr. T. W. V. Cross, Farm Foreman, for considerable assistance during the course of the trial.

The Toxicity to Grazing Animals
OF GRASS SPRAYED WITH A SOLUTION OF SODIUM ARSENITE.

By A. D. Husband, F.I.C., and J. F. Duguid, M.A., B.Sc.

During the recent locust destruction campaign the principal protective measure adopted throughout the Colony was the destruction of the offspring of the invading swarms, when in the hopper stage, by spraying them with a dilute solution of Sodium Arsenite.

Considerable alarm was expressed by many farmers that, owing to the cessation of the rains, the sprayed areas would be a potential danger to their grazing stock. As no definite information was available regarding the toxicity to cattle of grass sprayed with unsweetened arsenite of soda solution, farmers were advised to burn the grass as far as possible on all sprayed areas, thereby eliminating the possibility of animals being poisoned from this source.

It was realised that the burning of grass on the farm is an undesirable practice which in certain circumstances may be frought with considerable danger to the unsprayed grazing, but until more definite information regarding the toxicity of sprayed grass was available, there appeared to be no possible alternative safeguard.

In view of the lack of data regarding the persistence of the arsenic content of sprayed grass, it was suggested by the Chief Entomologist that this might possibly decrease from causes other than being washed with rain, as otherwise the potential danger to stock would appear to be much greater during the dry season than the results of his experience indicated.

It was considered that this problem was worthy of investigation, and the experiments detailed in this report were therefore laid down, and carried out in co-operation with the Chief Entomologist and the Director of Veterinary Research.

On reference to the literature it was discovered that there was a remarkable variation in the published figures by different authors as to the minimum fatal dose of arsenic to cattle. Wallis Hoar (1) gives 240-480 grains as producing poisonous effects in cattle, while Wynter Blyth (2) gives 10 grains as a dangerous dose. Finlay Dun (3) quotes Kaufmann as fixing the toxic dose at 240-480 grains; Mellor (4) gives 9.6 grains as a dangerous dose for a cow, and Theron and Hall (5) give 45-150 grains arsenic in the form of arsenite as the minimum weights required to kill cattle. Fuller (6) carried out experiments in which soluble arsenic was administered to cattle by spraying it over various types of fodder, and he found that the minimum fatal dose was 121 grains of arsenite. It is presumed that all these figures, with the exception of the last two, refer to arsenic as arsenious oxide (As_2O_3), but no mention is made as to whether the arsenic had been administered to the animals as white arsenic or in some other form. In the case of sodium arsenite, which is the compound with which we have to deal in locust poison, Green and Dijkman (7) point out that "the effects of oral administration of soluble arsenic are more erratic with cattle, owing partly to idiosyncrasy and partly to the fact that the dose may pass direct to the abomasum in one case, and indirectly through the rumen in another." In order, therefore, to obtain, if possible, somewhat more exact data regarding the toxic dose of sodium arsenite as found in locust spray powder, experiments were carried out on a number of old trek oxen discharged from other experiments. This work was kindly undertaken by the Director of Veterinary Research, who also made observations on the animals and performed a detailed autopsy in each fatal case.

Method of Dosing.—In each case the sodium arsenite was carefully weighed out in the Chemical Laboratory and was administered to the animals by placing the requisite dose on

the back of the animal's tongue. Immediately after dosing the animals were turned out into a small paddock where they had free access to food and water.

The various doses of sodium arsenite administered, the symptoms and the post-mortem findings in the animals, are detailed below in a report supplied by the Director of Veterinary Research :—

REPORT ON SYMPTOMATOLOGY AND PATHOLOGICAL ANATOMY OF CASES OF EXPERIMENTAL ARSENICAL POISONING.

Bovine No. 280.—This aged ox was in a very poor and weak condition at the time of commencing the experiment. Its live weight was estimated as being about 500 lbs. It was dosed with Locust poison powder containing 112½ grains of arsenious oxide.

Symptoms.—Six hours after being dosed the animal was standing and, apart from showing slight salivation, appeared to be unaffected. After 21 hours the ox was still up, was not feeding and showed a marked tendency to drag its feet when made to walk. After 27 hours it was lying down and restless, showing indications of abdominal pain, and on being made to rise walked with a staggering gait. During the night, approximately 40 hours after being dosed, it died.

Post-mortem Lesions.—Soft but not watery faeces, containing a large number of nodular worms, were present at the anus. Rigor mortis was incomplete. Inflammatory changes were present throughout the omentum; the mucous membrane of the omasum was found to strip off readily, leaving a slightly congested surface, and the contents of the omasum were soft. There was inflammation of the mucous membrane of the abomasum, the lesions being most marked in the pyloric region. The small intestine was inflamed throughout its length, the inflammation being most severe at the caecal end. Half way through the intestine the inflammation was in the form of zebra markings. The caecal contents were quite fluid and the mucous membrane showed very slight inflammation. Apart from its soft contents the large intestine showed no change.

Remarks.—The only pronounced symptoms were those of abdominal pain shown shortly before death and the staggering gait.

The inflammation of the omentum and small intestines were the only post-mortem lesions which would have lead one to suspect arsenical poisoning.

Bovine No. 272.—The previous experiment was repeated on this stronger ox, whose weight was estimated at 550 lbs., the dose given being again the equivalent of 112½ grains of arsenious oxide.

Symptoms.—Slight salivation was noted after 8 hours, and this was still in evidence after 24 hours, by which time the animal appeared somewhat dull but still attempted to feed.

After 30 hours the animal was very dull and would not feed, and on being made to walk showed marked swaying of the body and dragged the hind feet. This ox, also, died during the night, approximately 40 hours after being dosed.

Post-mortem Lesions.—The omentum showed slight inflammation and there was a distinct enteritis visible before opening the intestines.

Both the omasum and abomasum were inflammed, the latter being partially haemorrhagic.

The small and large intestines showed haemorrhagic inflammation. A few small haemorrhages were present under the capsule of the spleen and the bladder mucosa was congested.

Remarks.—The most pronounced symptom in this case was the weakness and staggering gait. Post-mortem lesions were more marked, particularly those in the intestines. In both animals which received 112½ grains of arsenious oxide the course of the affection was rapid, and a diagnosis of arsenical poisoning could not have been arrived at from the symptoms alone. Even the post-mortem findings could not be regarded as diagnostic.

Bovine No. 275.—This animal was in poor condition, but strong, and was estimated to weigh 550-600 lbs. It was dosed with the equivalent of 56¼ grains of arsenious oxide.

Symptoms.—The first symptoms were observed only after 40 hours when the animal was standing and showed slight indications of diarrhœa. At this stage the animal was also straining slightly and abdominal pain was present. The animal would not feed and showed slight salivation. After 50 hours the ox was lying down, dull, listless and grunting, and salivation and marked diarrhœa were in evidence. These symptoms increased in severity until death occured 73 hours after dosing.

Post-mortem Lesions. The abdominal organs throughout showed externally visible inflammatory changes. The omasal contents were soft and the mucous membrane stripped off readily leaving a hyperæmic surface. The abomasum was almost empty, the mucous membrane being intensely inflamed and showing ulcers up to the size of a 3d. piece. The small intestine contained only mucous and showed severe inflammation and slight ulceration. The intestinal wall broke very easily on being stretched. The cæcum was almost empty and showed severe extensive inflammation, the rest of the large intestine being slightly inflamed.

Remarks.—The symptoms and post-mortem lesions of this case were more pronounced and were typical of an acute gastro-irritant poisoning.

Bovine No. 279.—This fairly well conditioned strong ox of approximately 750-800 lbs. live weight was dosed with the equivalent of 30 grains of arsenious oxide, but whilst under close observation for 10 days appeared to be completely unaffected.

Bovine No. 283.—The previous experiment, using a 30 grain dose, was repeated with the above poor conditioned and somewhat weak ox of 550-600 lbs. weight.

Symptoms.—During the day following dosing, the ox was off its feed and showed slight diarrhœa. After 48 hours the animal was down and looked distinctly sick, with drooping ears and diarrhœa. After 56 hours the above symptoms were more marked and severe weakness had developed. The following day the animal could not be made to rise; diarrhœa was

more pronounced and the ox appeared generally worse. Death occurred during the night, approximately 86 hours after dosing.

Post-mortem Lesions.—Inflammation of the omentum, severe hæmorrhagic abomasitis with ulceration, general catarrhal enteritis affecting the small intestine and hæmorrhagic inflammation and ulceration of the cæcum were noted.

Remarks.—The symptomatology in this case was not as clearly indicative of arsenical poisoning as in the case of Bovine No. 275 which received a dose of 56¼ grains of arsenious oxide but the post-mortem lesions were clearly marked. It would appear that a 30 grain dose, although sufficient to kill a rather weak ox, may not affect a stronger one.

Bovine Nos. 281, 273, and 286.—These three oxen were in a similar condition to that of No. 283 and were dosed with 20 grains of aresnious oxide each.

All developed very mild diarrhœa after 24 hours which lasted for two days in the case of one animal and for only one day in the others.

Remarks.—A 20 grain dose tested on three animals was only sufficient to produce a transitory and barely noticeable condition of looseness.

The results obtained in the above dosing experiments show that, with oxen, the minimum fatal dose of finely powdered sodium arsenite is in the neighbourhood of 30 grains.

It is interesting to note that this quantity of sodium arsenite is contained in 2.2 pints of ordinary 7-day dipping solution, and hence the possibility of cattle being poisoned from this source is much greater than is generally supposed.

A further point of interest is the fact that where a large dose of sodium arsenite (112.5 grains) was given the post-mortem findings were not nearly as indicative of arsenical poisoning as where smaller doses had been ingested. The difference in tolerance of various animals to arsenic is well demonstrated by a study of the two oxen Nos. 279 and 283. Both of these animals received a dose of 30 grains of sodium

arsenite, and whereas the latter ox became very ill and died, the former animal appeared to be less affected than the three oxen which received a dose of only 20 grains.

TOXICITY OF SPRAYED GRASS TO GRAZING CATTLE.

Experiment I.—This experiment was designed for the following purposes:—

(*a*) To ascertain the quantity of grass, sprayed by the method recommended for hopper destruction, that an animal would need to consume in order to ingest a dose of 30 grains of Arsenious Oxide.

(*b*) To determine the arsenic content of the ash of burnt grass that had been sprayed as in (*a*).

Method.—Two grass plots each 50 sq. yds. in area were selected and marked A and B.

Plot A was sprayed with 1½ gallons of locust poison solution containing 1.3 ozs. of Sodium Arsenite Powder.

Plot B was sprayed with 4¾ gallons of solution containing 4.1 ozs. of Sodium Arsenite Powder.

After a period of 7 days the grass on both plots had withered considerably. Separate samples of grass were then taken from each plot and analysed for arsenic, a portion of each sample being burnt and the ash therefrom analysed separately.

Results of Analysis.

	Total Arsenic as As_2O_3. %
Plot A—Grass	0.12
Ash	0.26
Plot B—Grass	0.25
Ash	0.46

In considering these results, it must be remembered that the quantity of arsenical spray used in practice is dependent upon several factors, one of the chief of which is the density and height of the grass being sprayed. The average quantity of powdered Sodium Arsenite per acre recommended by the Entomological Branch is approximately 2 to 2½ lbs. In some

instances the actual quantity of material required to cover efficiently the area being sprayed may be considerably in excess of this amount, unless the spraying solution is made more dilute than that recommended.

In the experiment outlined above, the actual amount of Sodium Arsenite solution required to give an efficient light spraying represented approximately 8 lbs. per acre of powdered Sodium Arsenite. Under conditions such as this the danger to grazing stock is much greater than where smaller quantities of spray solution will suffice to give efficient spraying.

Taking 30 grains of As_2O_3 in the form of Sodium Arsenite to be the minimum fatal dose of arsenic for an ox, an animal would need to consume in order to obtain a fatal dose of arsenic 3.7 lbs. of the above lightly sprayed grass, or 1.7 lbs. of the ash therefrom; 1.8 lbs. of heavily sprayed grass, or 0.9 lbs. of the ash therefrom.

Conclusions.—These results would indicate that long and dense grass even lightly sprayed with Sodium Arsenite forms a great potential danger to grazing stock, but that this danger is removed when the grass is burnt, as it is highly improbable that cattle would be able to obtain 1 lb. of ash without licking up all the ash over a considerable area.

Experiment II.—This experiment was initiated with the object of determining whether the arsenic content of sprayed grass remained constant during the dry season, or whether the arsenic would disappear in the course of time.

Method.—Two plots—A and B—were selected, which were covered with a good growth of long grass, principally *Hyparrhenia.* Plot A was 130 sq. yds. in area and was evenly sprayed with a solution containing 9 ozs. of Sodium Arsenite Powder.

Plot B was 338 sq. yds. in area and was evenly sprayed with a solution containing 3 ozs. of Sodium Arsenite Powder.

It should be noted that the arsenic sprayed on this plot was at the rate of 2 lbs. 10 ozs. to the acre, therefore the arsenic content of the grass should be closely in accord with that of grass sprayed as recommended by the Entomological branch.

The grass was sampled the day after spraying on each plot, and further samples were taken at monthly intervals for two months.

Results of Analysis.

	Plot A. Heavy Spray. % As_2O_3.	Plot B. Light Spray. % As_2O_3.
Sample 1—Day after spraying	0.176	0.052
Sample 2—After interval of 4 weeks	0.092	0.042
Sample 3—After interval of 8 weeks	0.100	0.025

Conclusions.—These results indicate that there is a progressive decrease from month to month in the arsenic content of grass sprayed with Sodium Arsenite solution, irrespective of rainfall.

Experiment III.—In order to test whether grass very lightly sprayed with Sodium Arsenite was palatable to cattle and, if so, whether it would prove toxic to them, it was decided to graze an animal on a fenced in plot that had been sprayed.

Two plots—C and D—were sprayed with Sodium Arsenite at the rate of ½ oz. of locust poison to 100 sq. yds. This corresponds to a spraying at the rate of 1½ lbs. of Sodium Arsenite per acre which is probably considerably lighter than that ever applied in practice on farms.

Plot C consisted entirely of *Urochloa mosambicensis* and plot D carried a heavy cover of *Digitaria scalarum*. The grass on each plot at the time of spraying was in a dried-up condition.

The dried-up grass on each plot was sampled two days after spraying and was found to have an arsenic content of approximately 0.05 per cent. This corresponds to approximately 10 grains of arsenious oxide to each 3 lbs. of grass.

An ox, No. 279, which had been used in a previous experiment and had received a dose of 30 grains of arsenious oxide from which it showed no ill effects, was placed to graze on Plot C, and was kept under observation by the Director of Veterinary Research, who reports as follows:—

"**Bovine No. 279.**—For the first day the ox grazed fairly readily, but after that refused to eat the remains of the sprayed grass and it became necessary after four days to provide better grazing, which it readily made use of.

"During the third day the fæces appeared somewhat soft and there were indistinct indications of slight abdominal pain. Weakness became pronounced, but this was attributed to lack of food.

"On being supplied with suitable food the ox made an uneventful recovery."

Remarks.—The small amount of sprayed grass which was ingested was apparently sufficient to cause mild discomfort and consequently the ox refused to take in more, with the result that only an unestimated sublethal dose of arsenic was ingested.

In view of the fact that this ox had previously shown no symptoms of poisoning from a fairly large dose of arsenic, and also that the quantity of sprayed grass that it had consumed in this last experiment was very small, it was decided to repeat this experiment on Plot D, using another ox. The following observations made on this animal were also supplied by the Director of Veterinary Research.

"**Bovine No. 284.**—This large, thin, but strong animal, was placed on the sprayed grass in Plot D.

"A fair amount of the grass was grazed during the first day. On the second day the animal was not seen feeding and its fæces were softer, otherwise nothing unusual could be detected. On the 3rd day the fæces were soft, muscular tremors and salivation were noted, and on walking there was swaying and weakness of the hind quarters. Attempts at defæcation were frequent, and although the animal refused to graze it readily ate manna hay. By the afternoon of the same day weakness had progressed and there was complete inappetence. During the fourth day diarrhœa was profuse, the fæces containing particles of blood stained mucous and pieces of mucous membrane. Weakness was by now very pronounced and all food was refused. Later the animal was lying down and grunting.

"The following morning the ox was still able to stand but all other symptoms were more severe and death occurred in the afternoon, 100 hours after being placed on the arsenic sprayed grass.

"*Post-mortem Lesions.*—The omentum showed inflammatory changes. In the unpigmented smooth areas of the rumen the mucous membrane stripped easily. Likewise the mucous membrane of the reticulum was easily removed by scraping. The omasum contained dry ingesta and its mucous membrane was stripped off fairly easily. The œsophageal grove showed distinct inflammation and its mucous membrane stripped with ease. The abomasum contained fluid ingesta and showed severe hæmorrhagic gastritis with numerous hæmorrhagic ulcers of varying size. The small intestines contained bile stained mucous and showed a generalised catarrhal condition with a few small ulcers, and hæmorrhages. The large intestine contained fluid bile and somewhat blood-stained fæces. There was a severe hæmorrhagic inflammation of the cæcum with large hæmorrhagic ulcers."

Remarks.—The symptoms and *post-mortem lesions* in this case were typical of arsenical poisoning. From the comparatively long duration of the affection it would seem that only a small quantity of arsenic was ingested, but this produced death after a characteristic course.

Conclusion.—The results of this experiment show that it is possible for an animal to be poisoned from eating grass that has been only very lightly sprayed with Sodium Arsenite solution.

In this experiment the animals used were confined to grass that had been sprayed, therefore this result is no criterion as to whether under normal conditions of grazing an animal would readily consume such grass.

Owing to the fact that grass, after spraying with arsenic, rapidly withers and turns brown, it is highly improbable that animals would find it as palatable as green grass.

Therefore during the summer months it is improbable that the potential danger of sprayed grass to cattle is as great as

its high arsenic content would make it appear, particularly as the first shower of rain would leach away a considerable portion of the arsenic.

The position during the dry season would appear to be much more serious. Although the results obtained in Experiment II. show that the arsenic content of sprayed grass diminishes considerably in a period of eight weeks, irrespective of rainfall, it is of importance that, even after this period has elapsed since spraying, animals grazing such grass can still easily consume a fatal dose of arsenic. It is also possible that the palatability factor is entirely different during the dry season, as animals not regularly receiving salt undoubtedly show a definite salt craving, and under such conditions may possibly prefer sprayed grass to normal veld grass.

In order to avoid possible losses of stock, it would appear imperative, therefore, that grass sprayed just prior to the commencement of the dry season should be either fenced off or burnt. Only where these precautions are taken can it be certain that the grazing stock are fully protected against the danger of being poisoned from this source.

DISTRIBUTION OF ARSENIC IN THE ORGANS OF OXEN POISONED WITH SODIUM ARSENITE.

Cases of arsenical poisoning among cattle are of frequent occurrence in the Colony and are largely occasioned through the careless handling of concentrated arsenical cattle dips. It is the custom of veterinary officers, when carrying out post-mortem examinations on animals suspected of having died from arsenical poisoning, to send samples taken from the abomasum of the dead animal to the laboratories for analysis for arsenic. In some cases, although the post-mortem findings give definite indications that the animal died from acute arsenical poisoning, chemical analysis of the contents of the abomasum fails to reveal more than the merest trace of arsenic. In these cases it is impossible for the chemist to give any reliable confirmation to the diagnosis of the veterinarian.

In the foregoing experiments it was found that a considerable period may elapse before the death of an animal occurs as a result of ingesting a fatal dose of arsenic, although

diarrhœa and symptoms of arsenical poisoning may occur in a comparatively short time. It is not surprising, therefore, under such conditions, that it may be impossible to detect event a trace of arsenic in the abomasum of an ox or cow that has died four days after consuming a small dose of a readily soluble arsenic compound.

Absorption of dissolved arsenic from the digestive tract is known to be very rapid, and a few hours after ingestion it may be found in the urine or milk. Evidence regarding the elimination of arsenic appears to be somewhat contradictory. Lander (8) reports that arsenic is eliminated very rapidly, chiefly by the kidneys, and is complete within two or three days. Autenrieth (9) states that "elimination of arsenic takes place mainly through the urine. It begins several hours after administration and usually lasts 4-7 days. A great many experiments have shown the duration of arsenic elimination in urine to vary from a few days to several weeks. Some observers have found arsenic in urine 80, and even 90 days, after poisoning."

Cushny (10) describing the metabolism of arsenic in man states "arsenic is excreted very slowly, some appearing in the urine and fæces within 24 hours, but only about one-fifth of that absorbed being eliminated in this way. The rest is stored in the tissues for a long time, and slowly got rid of in the hair and epidermis, in which arsenic may be found for many months after it has disappeared from the urine and fæces."

On several occasions cases have occurred in these laboratories where samples of viscera as well as stomach contents have been sent in for analysis by veterinary officers in cases of suspected arsenical poisoning, and in several instances arsenic has been found in the liver or kidney when no trace could be found in the stomach contents.

In order to obtain more definite data regarding the distribution of arsenic in the body of cattle poisoned with Sodium Arsenite, analyses were made of various organs taken from the animals that had died in the foregoing experiments. The results of these analyses are given in the following table.

Graphs I. and II. show the content of arsenic in the various organs as compared with the number of hours that elapsed between the arsenic being administered and the death of the animal.

			Millegrams As_2O_3 per 100 gram sample.						
Bovine No.	Dose As_2O_3 in grains.	Interval in hours between dose and death.	Omasum.	Rumen.	Reticulum.	Kidneys.	Abomasum.	Liver.	Intestines.
280	112.5	—	—	4.46	3.30	2.31	2.64	1.49	1.32
272	112.5	48	5.28	5.78	5.28	3.30	2.31	2.15	1.49
275	56¼	72	3.31	2.31	—	2.97	1.65	1.32	1.49
283	30	96	1.98	1.32	—	1.49	Trace	Trace	Nil

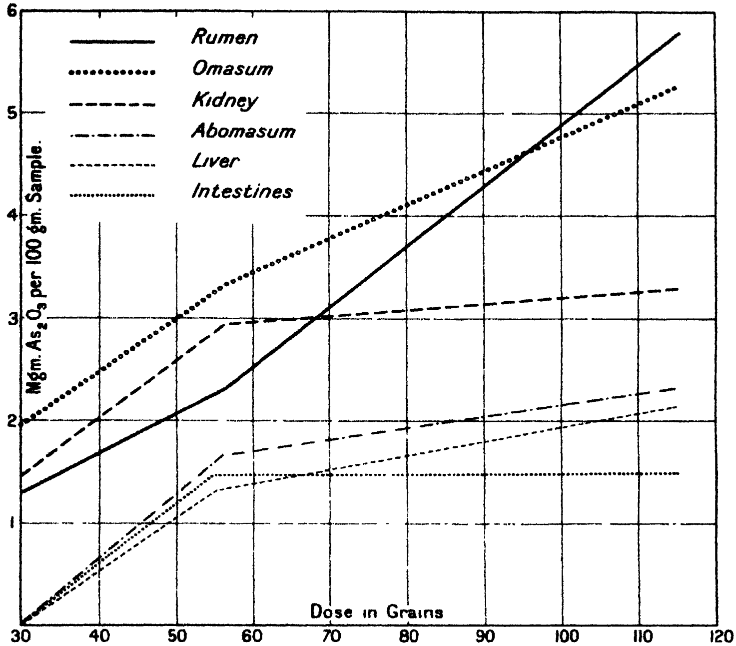
The above analytical data show that where a large dose of Sodium Arsenite was ingested and death took place fairly quickly, the arsenic could be found in an estimable quantity in all the organs analysed. In the case of the ox in which an interval of 96 hours intervened between the ingestion of the arsenite and death, the quantity of arsenic found in the organs was considerably less, and no trace could be detected in the intestines. This demonstrated that in cases where an animal has purged badly for some time as the result of ingesting a small dose of arsenic, it is quite possible that the contents of the fourth stomach and the intestines may show no arsenic upon analysis, although the animal may definitely have died from arsenical poisoning.

It would appear, therefore, that more reliable information as to whether arsenic has been ingested is obtainable from an analysis of the omasum or the kidney than from an analysis of the abomasum.

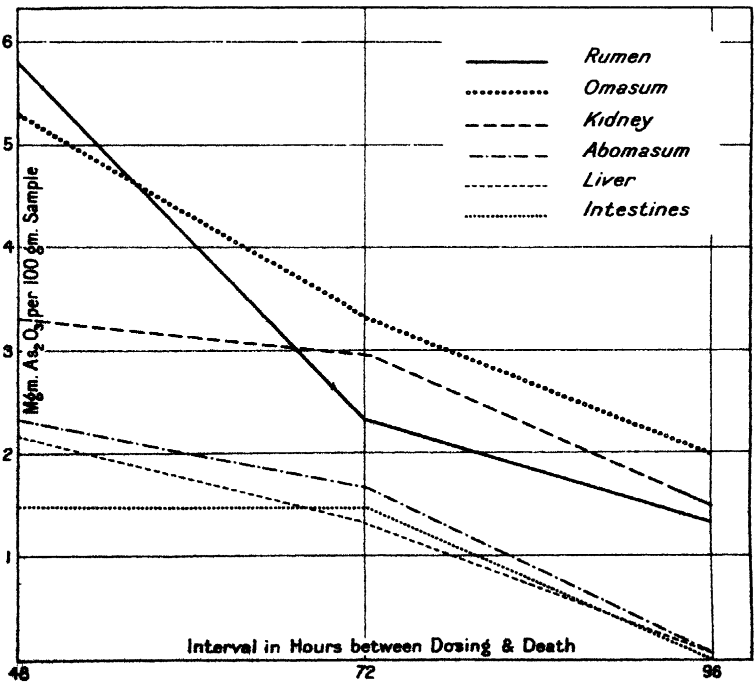
SUMMARY.

1. Experiments were laid down to determine whether grass sprayed with Sodium Arsenite solution formed a potential danger to cattle. The minimum toxic dose was first determined and found to be in the neighbourhood of 30 grains.

GRAPH 1.



GRAPH 2.



2. The results of analysis of long and dense grass sprayed lightly with Sodium Arsenite solution showed that it forms a great potential danger to grazing stock; protection against this danger should be afforded by fencing or burning the sprayed grass.

3. There is a progressive decrease from month to month in the arsenic content of grass sprayed with Sodium Arsenite solutions, irrespective of rainfall.

4. The possibility of animals being poisoned by grazing on very lightly sprayed grass was tested by placing an animal on a small fenced plot, the grass of which was sprayed with Sodium Arsenite at the rate of 1½ lbs. to the acre. The animal died from arsenical poisoning in 96 hours.

5. Analyses of the organs of the animals poisoned in the experiments were made to determine the distribution of arsenic in the body. The results showed that the omasum and kidney give more reliable information than the abomasum as to whether arsenic had been ingested.

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Citrus Fruit Growing in Rhodesia.

By G. W. Marshall, Horticulturist.

Introduction.—Five years ago an article bearing the above title appeared in this Journal, but in bulletin form it has for some time been out of print. Since that date a considerable amount of experimental and investigational work has been conducted throughout the citrus-growing countries of the world, and as a direct result we are now more conversant with the requirements of citrus trees than we were then.

The time, therefore, seems appropriate for writing up this subject again, and in doing so it is proposed to deal with all the important phases of the industry to enable the beginner to establish and maintain his small or large planting in the best possible manner.

Rhodesia has vast tracts of country suitable for the growing of citrus fruits, and the writer has been agreeably surprised at the excellent results obtained under a very wide range of soil and climate conditions. Citrus fruit trees have been successfully established in Rhodesia at elevations up to 6,000 feet, and the soils chosen vary from light sands to heavy loams, and the advice here tendered is based upon personal observations within the Colony, supported and enhanced by successful practice in citriculture in other parts of the world.

There are ups and downs in all branches of farming, particularly when seasons and markets are unfavourable, but the average net profits derived from well tended citrus groves are usually sufficient to warrant the undertaking.

If a sound agricultural venture is contemplated it is advisable to adopt a system of mixed farming in preference to depending entirely on one branch of agriculture, and as there is an ever-increasing consumption of citrus fruits brought about by extensive advertising and propaganda work, the citrus industry should commend itself to those wishing to augment their income.

Climate.—Southern Rhodesia, with a few exceptions, possesses a desirable climate for the successful growing of most citrus fruits. There are, however, three factors that require careful consideration, namely:—

Winds.
Temperatures.
Rains.

Wind.—There is little if any necessity to consider the wind factor during the greater portion of the year, as this Colony is singularly free from injurious wind storms during the months of November to July. In the remaining months of August to October the wind is fairly strong and consistent, and if adequate provision is not made to exclude these dry winds from citrus groves there is every reason to assume that the setting of the fruit that takes place at this season of the year will be adversely affected. What actually occurs in an unprotected citrus grove during this dry and windy period may be summarised briefly as follows:—

When citrus trees are in active growth during dry and windy weather the transpiration of moisture (through the plant's breathing pores) exceeds the absorption of soil moisture by the tree's root system, and when this occurs an excessive wilting of the young growth and newly set fruit will be the result. This wilting becomes more pronounced as the summer temperature increases, and must be prevented, otherwise a heavy drop of immature fruit will be the result, due to the re-absorption of a portion of the moisture content from the fruit by the foliage.

In a citrus grove well protected by wind-breaks the transpiration of moisture is considerably reduced during dry and windy weather, and the evaporation of soil moisture is also restricted, thereby enabling the trees to function in a normal manner. If our atmospheric moisture were high at this season of the year the winds would not produce this excessive wilting and good crops of fruit could be expected even in unprotected groves. The humidity of the atmosphere along the eastern border is relatively high when compared

with the rest of Rhodesia, and the further west we proceed from this area the greater becomes the necessity of providing suitable shelter for the groves.

Temperatures.—In the tropics this factor is generally of minor importance. Owing to our altitude, we experience a temperate to sub-tropical climate in most districts of the Colony, and these areas are ideal climatically for the production of citrus fruits on account chiefly of the absence of extremes in temperatures. In a few areas located at the lower elevations sun-scald is at times somewhat troublesome. This may be overcome to a marked degree by choosing a site for the citrus grove with a southern or eastern aspect, or when tall-growing trees are established on the western side of the grove.

Low temperatures must be considered occasionally, and citrus trees should not be planted at the highest elevations where severe frosts occur, nor along water courses or low-lying ground where the temperature may fall below 30° F. Many citrus varieties differ in their degree of resistance to low temperatures, and it would not be wise to establish some of them where the minimum temperatures fall below that stated. At or above this temperature there is little or no fear of injury occurring to the trees or fruit. It is undoubtedly an advantage to have slight frosts during the winter months. Low temperatures improve the colour of ripening fruit and retard the ravages of many insect pests, besides improving the physical condition of many soils.

Rainfall.—Rhodesia enjoys a summer rainfall ranging from an annual average of about 10 inches along the south-eastern border, 20 to 25 inches through the Midlands and western territory, 30 to 35 inches or more over the higher elevations of the north-eastern areas, and occasionally 100 inches or more along some of the mountainous regions of the eastern border.

Owing to the greater portion of the precipitation occurring during a comparatively short season (November-March) it is unwise to establish citrus groves where irrigation is not possible.

Citrus growing countries experiencing a summer rainfall have many advantages over countries with a winter precipitation, the chief being the absence generally of any need to irrigate during the period of most active tree growth and fruit development. Further, a greater variety of suitable cover crops may be grown during the summer months, and the fruit also is harvested and marketed in the dry season and thus has better carrying and keeping qualities than fruit harvested during damp or wet weather.

Selection of the Site.—The most important factors to be considered when selecting a site for the establishment of a citrus grove are suitability in respect of:—

(*a*) Aspect.
(*b*) Soil.
(*c*) Irrigation possibilities.
(*d*) Shelter.
(*f*) Transportation of fruit.

If one or more of these factors are disregarded when selecting the site, poor and unprofitable crops of fruit may be the result.

Aspect.—The best site to select for the citrus grove is one with a gentle southern or eastern slope. Northern and western aspects are often undesirable.

The slope of the site should not be excessive if soil erosion is to be avoided during heavy rain storms or irrigation. The best slope for planting citrus trees will vary with the nature of the soil, but it should never, if possible, exceed one in a hundred.

Situation of Site.—If severe frosts or hail storms have been experienced in the vicinity of the site favoured, careful enquiries should be made, and if there is any likelihood of severe damage occurring from these causes the locality should be avoided. Fortunately the greater portion of Southern Rhodesia suffers little from either of these troubles, and they seldom need to be considered.

The soil must be suitable for citrus trees and must be capable of being irrigated, preferably by gravitation. The site must also naturally be sheltered from winds or be capable of being sheltered artificially. Where possible it should be located near a good road or railway line.

Soils.—Citrus fruit trees are grown on a variety of soils throughout Southern Rhodesia, ranging from light sands to heavy loams. The yields, quality and keeping properties of the fruits produced on such a range of soils vary considerably, and if payable crops of high quality and good keeping properties are to be successfully produced, great care must be exercised in selecting the soil. Heavy soils are undesirable; they are difficult to work and the quality of the fruit they produce is often poor. The trees are also more susceptible to root diseases, particularly during wet seasons, when this class of soil is likely to become water-logged, though good quality fruit may be produced in such soils during dry seasons. The disadvantages of the heavy soils outweigh the few advantages they may possess, and they should be avoided if lighter soils are available. The best soil for the profitable production of citrus fruit is a light or medium sandy loam with good depth and drainage. Citrus trees will not tolerate wet and cold sub-soils.

Suitable soils as described above will furnish the trees with a large root-feeding area. The trees are capable of growing to a large size, living to a great age and producing large crops of good marketable fruit.

On shallow soils with impervious clay sub-soils or overlying solid rock, young trees may thrive and flourish for a few years, but when the tap roots encounter the objectionable sub-soil the trees will rapidly decline or die and prove a great disappointment to the owner.

If sandy loams are unavailable in any given locality it would then become necessary to select a medium loam which may be either grey, chocolate or red in colour. Heavier soils than these recommended should be avoided if best quality fruit is desired.

A simple classification of Southern Rhodesian soils suited for citrus culture is:—

(1) Alluvial sandstone formations.
(2) Medium texture granitic deposits.
(3) Contact soils of a sandy nature.
(4) Medium loams.

The minimum depth of a good citrus soil must not be less than four feet, and it should be well drained naturally.

The root system of a citrus tree differs from that of many other trees, in that it develops both tap and lateral roots strongly. The tap root is well defined and strikes downward into the soil, whereas the lateral roots develop horizontally and they are frequently to be found within a few inches of the surface of the ground. These roots are often referred to as the drinking or feeding roots of the tree. See Fig. 1.

Early South African planters realised that their seedling orange trees would often only thrive up to a certain stage and then rapidly decline or die. Upon investigation it was usually discovered that the tap roots of the dead or unthrifty trees has encountered objectionable sub-soils. To overcome this trouble many of the subsequently planted trees were set in groves over a large flat stone, the idea being to deflect the tap roots and produce a secondary system of lateral roots. The object in view was defeated owing to the tap roots again striking downward immediately they came to the edge of the flat stones. This method of planting is still practised by a few of the older South African farmers.

During Dr. H. J. Webber's* citrus survey of South Africa in 1925 he was particularly impressed with the layered citrus trees he had seen in the Cape and Transvaal Provinces of the Union of South Africa. Many of these trees were of great age and in most instances had out-lived the seedling trees planted at the same time. As the layered citrus trees are devoid of tap roots this would possibly account for their longevity. Layered trees are more suited to the shallower

*H. J. Webber, Ph.D., D.Agr., Director, Citrus Experiment Station, and Professor of Sub-Tropical Horticulture, University of California, U.S.A.

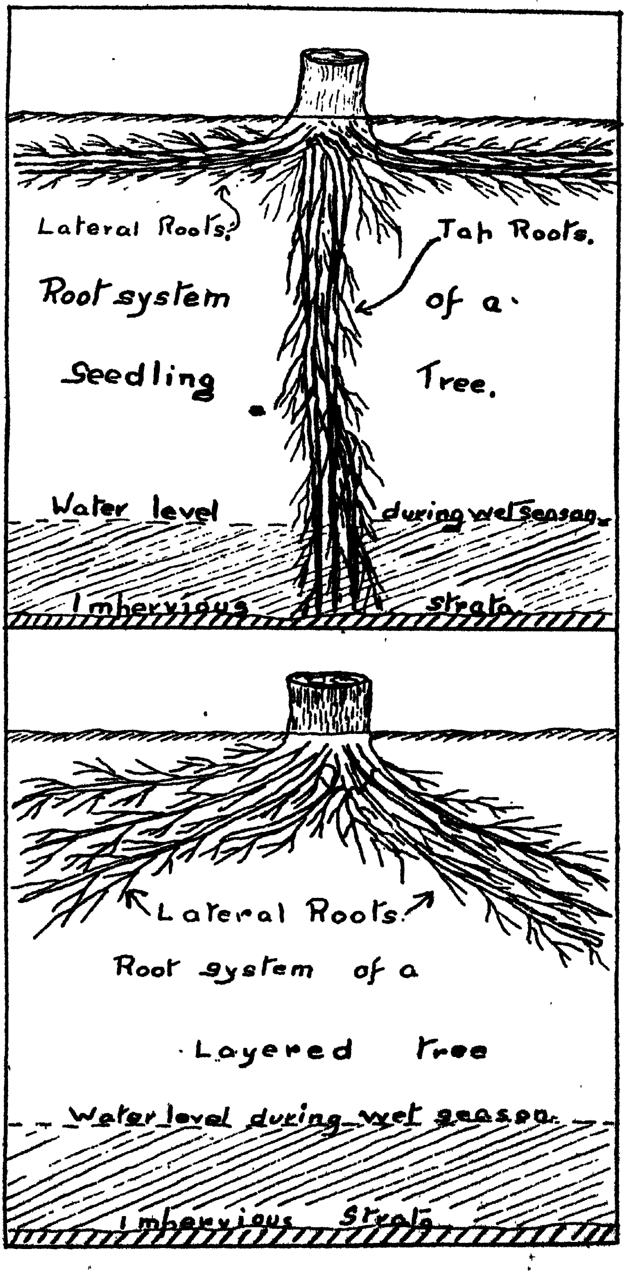

Lateral Roots.
Tap Roots.
Root system of a Seedling Tree.
Water level during wet season.
Impervious strata
Lateral Roots
Root system of a Layered tree
Water level during wet season.
Impervious strata

Fig 1.

soils, on which they are likely to prove a greater commercial success than seedling or grafted trees. For the variations in citrus tree root formation see Fig. 1.

Shelter.—Many old and unprotected citrus groves are to be found at the present time in South Africa. If the owners of these groves were to realise what their annual crop losses were on account of lack of shelter they would be astounded. While dealing with this subject it may be well to refer to what actually occurred on a Western Transvaal estate. Nearly 20 years ago an unprotected and grossly neglected citrus grove was acquired by its present owner, who immediately established shelter belts of rapid-growing trees round the groves; he also adopted modern manurial and cultural methods, with the result that the annual crops of fruit increased in seven years from 400 cases to 25,000 cases. This increase in crop production was most pronounced when the citrus trees derived benefit from the rapidly growing shelter belts. The crops harvested were 11,000 cases in 1923, 17,000 in 1924 and 25,000 in 1925. The shelter belts protecting these groves were from 15 to 20 feet in height in 1923, and at the end of 1925 the same trees had attained a height of from 30 to 40 feet.

This instance of the increased crops of fruit harvested from the sheltered groves is an outstanding example of what may be done in the way of sheltering even old trees. These shelter belts were undoubtedly largely responsible for the greater portion of the increase in crop production, since on the few small sections where the citrus trees received inadequate shelter the crops were generally very poor, although all of the trees had received the same manurial and cultural treatment. One of the additional benefits derived from these shelter belts was the marked improvement in the outward appearance of the fruit, there being little or no mechanical injury throughout the adequately protected sections. Of all the fruit harvested, there was slightly under 3 per cent. of "culls"; most of this injury could be attributed to other causes than wind, the chief being thick-skinned and malformed fruits.

The citrus groves just referred to were inspected by Dr. H. J. Webber during his tour of investigation of the South

African citrus industry. He was particularly well impressed with what he saw, and at the time stated that the trees were the best conditioned that he had so far seen in South Africa.

Reference has been made to the importance of providing suitable shelter for the groves where no natural protection is to be found. The following remarks will be confined to when, how and what to plant.

Having selected a suitable site for the grove, shelter belts, unless already existing naturally, should be established without delay. It is to the advantage of the citrus trees if shelter belts which are required to be established be planted a few years in advance of the grove they are to protect, as young citrus trees require protection from the time of first planting out if the best results are to be assured. This is not always feasible, however, particularly with new arrivals to the country who desire to establish groves without unnecessary delay. In instances such as this the shelter trees should not be planted later than the fruit trees they are to protect, and meanwhile rows of some of the more quick-growing temporary shelter plants such as dhal may be planted at close intervals around and through the grove to afford protection until the permanent shelter trees become effective.

The best time of year to plant all shelter trees is during the months of December and January; by planting at this season, when rains are usually frequent, it should be possible to establish the trees well before the dry season commences.

The preparation of the land for the grove and shelter belts should be effected at the same time if both the fruit and shelter trees are to be planted the same season. The soil should be deeply ploughed and brought to as fine a state of tilth as is possible. This preparation of the land is by far the most important factor in the successful establishment of a shelter belt. Many dismal failures in the establishment of shelter or other trees are often recorded, and upon investigation it is usually found that little attention had been devoted to preparation of the soil, very small holes perhaps having been dug or the trees planted in a careless manner. The few

trees that survive such treatment are generally stunted or weakened to such an extent that they fall early victims to the ravages of white ants or some other pest.

After the soil has been brought into the best possible condition the shelter belt rows should be pegged with the inner row parallel with that of the intended first row of citrus trees, but 70 feet distant. This row should be pegged according to the distance apart it is intended to space the shelter trees, this being usually 8 feet. Each subsequent row should then be pegged in such a manner as to have the trees alternating or three trees forming equilateral triangles. Each side of the grove to be protected should be pegged in the same manner, and the process will be the same if it be two or more rows of shelter trees.

In Fig. 2 a general lay-out of the grove and shelter belts is illustrated, and in Fig. 3 a corner of the shelter belt is illustrated to show the alternating three-row belt.

After the pegging process is completed the tree holes should be dug the same size and in the same manner as described under planting of the citrus trees.

All young shelter trees should be carefully lifted with a good ball of earth attached to the root system; if any bent or damaged root is visible it should be carefully cut out before planting. The small trees may then be set into their permanent positions at the same depth as they originally stood in the tins or nursery beds. After filling in the necessary soil the trees should be well firmed and watered if weather conditions render it advisable.

Cultivation should be given to the soil round each tree after each watering or during dry spells between the rains. This is extremely important, as it keeps down weed growth, conserves soil moisture and allows the trees to grow unhindered. If the necessary care and attention are paid to the young newly-planted tree it should be possible to secure an even stand of uniformly well-grown trees to furnish the required shelter.

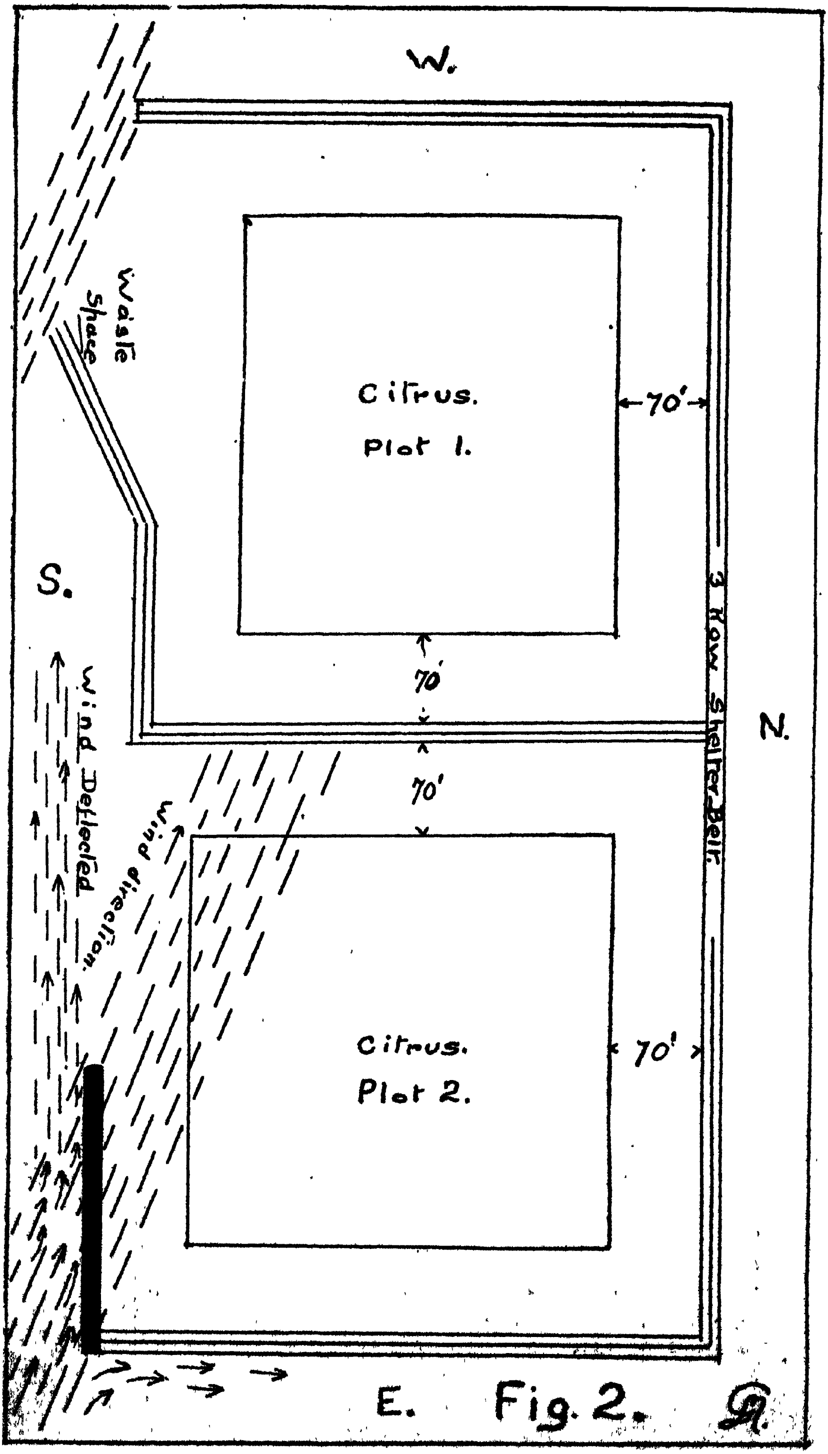

W.
S.
N.
E.
Waste Space
Citrus.
Plot 1.
70'
70'
70'
Citrus.
Plot 2.
70'
3 Row Shelter Belt.
Wind Deflected
Wind direction.

Fig. 2.

The sides of the citrus grove that require most shelter are usually the north-west and east and a projecting south arm of one-third to one-half of this side.

In Fig. 2 the southern arm is depicted by a black bar. This additional shelter will protect the whole grove from the south-east winds, as it assists in deflecting the wind from the otherwise unprotected south-western corner of the grove.

When the shelter belts are arranged as suggested for plot No. 2 (Fig. 2), the citrus trees will be protected from both the south-east and north-west winds, sun injury will be minimised and the necessary air drainage will remain unaffected.

With plot No. 1 (Fig. 2) it will be noticed that an additional shelter arm is provided running south-west-west. Since this means more waste space with this method, the system is not advised.

It is an advantage to plant three or more rows of shelter trees if the maximum amount of protection is to be secured. The outer rows should be rapid, tall-growing trees and the inner rows trees of a bushy habit of growth which are usually slower growing. All of the trees may be spaced in rows 8 feet apart with 8 feet between trees. The wide space between the rows will permit of better cultivation and allow the root systems more feeding space.

The shelter belt should not be so dense as to stop all wind completely; a certain amount of air should pass through the trees, thus acting as a cushion for the wind which has been lifted overhead by the shelter belt.

The varieties of trees recommended for shelter belts are :—

Tall-growing trees for outer rows: Eucalyptus tereticornis and Eucalyptus saligna; the latter do best at the higher elevations.

If eucalyptus trees are objected to and the soil is sufficiently sandy, Pinus insignis will be found suitable for the outer rows.

For the inner rows Callitris calcarata, Callitris robusta, Cupressus torulosa and Cupresses lusitanica may be planted,

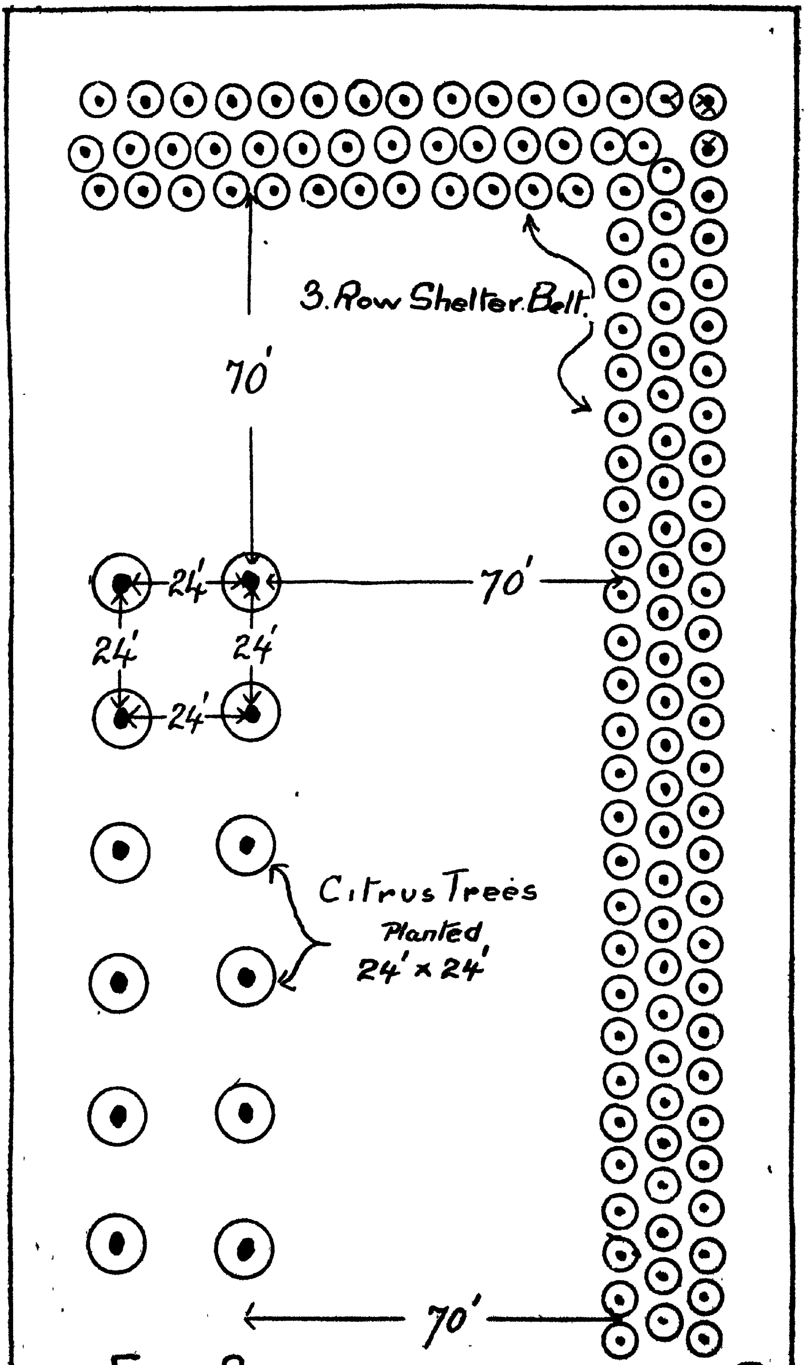

3. Row Shelter Belt.
70'
24'
24'
24'
24'
70'
Citrus Trees
Planted
24' x 24'
70'

Fig 3.

but the latter only where the rainfall is heavy or irrigation is possible.

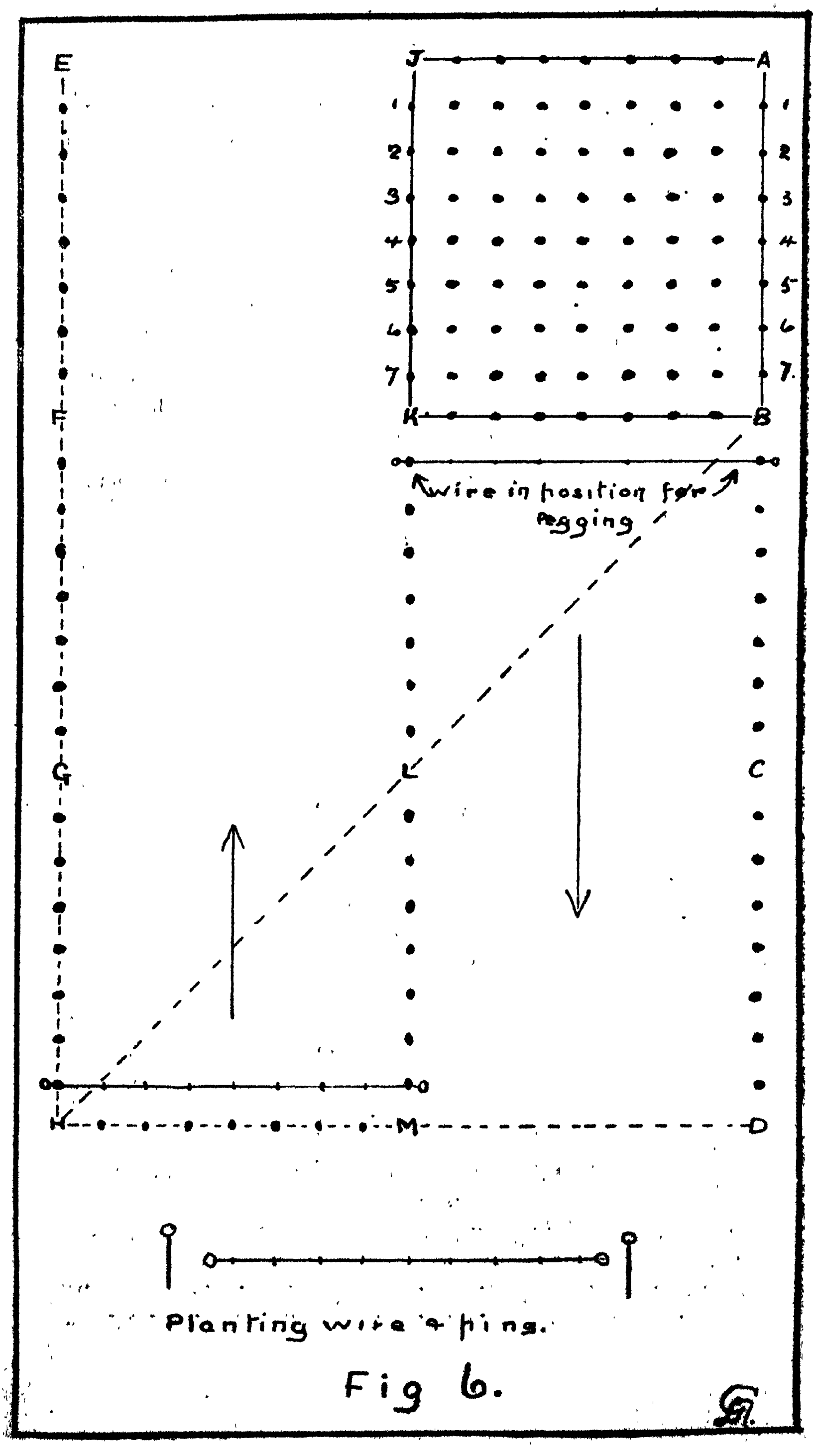
Many other varieties are suitable and may be planted, but those specially mentioned will furnish a sufficiently wide range to select from for average climatic conditions.

Fig. 4 illustrates a eucalyptus shelter belt which is devoid of undergrowth and is planted too near the grove; note the trench dug to sever the encroaching roots; this trench should have been filled in at once (undesirable shelter).

Preparation of Land.—The ground should be deeply ploughed and brought into good tilth; this is possible if performed towards the end of the rainy season—about March. When the ground is prepared at this season most of the soil moisture will be conserved and the later operation of digging the tree holes will be made easier.

It is also necessary to give the most careful attention to the problem of how to irrigate the proposed site of the grove. The advisability of grading the land before the trees are planted cannot be too strongly emphasised, as the efficiency of the irrigation scheme so much depends upon the proper grading of the situation. After grading, the whole area should be re-ploughed, cultivated and brought into the best possible condition, and if it can be arranged a trial irrigation should be given to ascertain which fall will be most suitable for planting the rows. The rows should preferably be short, with not more than 15 trees to each row. Such rows would be 120 yards in length and the fall should be about 6 inches per 100 feet, according to the nature of the soil, sandy soils requiring a greater fall than those of a medium or heavy character.

When trees are planted on an ungraded soil continuous trouble will confront the grower, and as it is neither easy nor economical to grade the slopes of an established grove, this work should be done prior to the planting. The additional cost of a properly graded site is more than justified on account of the ease with which all of the cultural and irrigation operations may be performed. On ungraded slopes the trees will receive irregular supplies of water, and this in turn will necessitate more frequent irrigation, while additional labour



E
F
G
H
J
A
K
B
L
C
M
D
wire in position for pegging
Planting wire & pins.

Fig 6.

will be necessary to control the irrigation water. Depth of ploughing will also be uneven; silting will occur in the depressions, thereby endangering the health of many of the trees, and the texture or quality of the fruit may be adversely affected.

Laying out the Grove.—After preparing the chosen site in a thorough manner it should be carefully laid out with the rows of trees planted along the contours, allowance being made to permit of the irrigation water flowing evenly without displacement of the soil. The necessary appliances for the pegging out of the site are:—

Planting wire to set nine tree pegs at a time (68 yards). For this purpose No. 16 galvanised plain wire could be used, and lumps of solder or rings of wire should be connected at the distances apart it is intended to space the trees. A 3-in. ring must be attached to each end of the wire 6 ft. from the end solder mark. This facilitates the adjusting of the wire to its exact position when the pegging operation is proceeding. Two ½-in. iron pins 24 ins. in length will be suitable to hold the wire in position while the marker pegs are being set. Sufficient white wooden pegs or Spanish reeds 12 ins. to 18 ins. in length and about 1 in. in diameter should be available to allow of using three pegs for each tree to be planted. A few 3-ft. pegs are also necessary for setting the corner and wire length main pegs. These pegs are represented by letters in Fig. 6.

The systems for the laying out of groves and orchards are:—

(1) The square or rectangular.

(2) The hexagonal or equilateral triangle.

(3) The quincunx.

Of these, the square or rectangular method is recommended for adoption in Rhodesia where land is inexpensive. This square system facilitates all cultural operations, chiefly on account of the wider middles (space between the rows of trees). It permits of ploughing and cultivation being carried out in four directions, and each tree has a greater root-finding area than that obtained in other systems of planting.

The hexagonal or equilateral system of laying out a grove will allow of more trees being planted to the acre, 86 trees being necessary for the hexagonal as against 76 trees for the square system. The hexagonal system of planting has one great disadvantage as compared with the square system, in that ploughing and cultivation can only be done in three directions.

The quincunx system is only of use where temporary trees are to be planted among permanent ones. The lay-out of this system is the same as that of the square system, but with a fifth tree in the centre of each four permanent trees.

If a mixture of citrus and paw-paw trees is desired this system will be found ideal. Paw-paw trees being short-lived, they may be used as the temporary fifth tree and then rooted out when the citrus trees require additional space. The square system of planting being considered to be the most suitable for Rhodesian conditions, there is no necessity to deal further with the other systems referred to.

Many writers in the past, in dealing with the pegging process, have recommended the setting of right angles at one or more of the corners. This is difficult to do accurately without expensive appliances, and to overcome the likelihood of repeated failures occurring in the process a simplified method is illustrated (Fig. 6) and may be described as follows:—

This system is better adapted for the laying out of groves planted on the contour where the corners need not form true right angles.

In Fig. 6 the first row A B C D (having the necessary uniform fall for irrigation), being the longest side, should be chosen to form the base line. This line should be completely pegged at every mark on the wire, using 3-ft. pegs at each end mark and shorter pegs between. In the illustration of this figure, letters represent long pegs and dots denote the short pegs.

Fig 4.—An undesirable shelter of eucalyptus trees with no under protection and planted too near the grove. The roots affect the first row of citrus Note trench cut to destroy encroaching roots. Trench still to be filled in.

When this base line is completely pegged the marking wire must be taken to peg A, where it is set at the angle the corner will form; if the shelter belt has been established, this will be simple, for both the base and side lines should be spaced 70 ft. from the shelter belt. The nearer the corner at A approaches the right angle the better. Having decided the direction this line will take, place the marking wire in position with the first solder mark against peg A, then draw the wire taut and set peg J at the furthest mark from A. The peg A end of the wire must then be taken round to K, where peg K is to be set, the J end of the wire being taken to peg B and the distance between K B corresponding with the two end marks on the wire; if not, peg K must be adjusted to the correct position. When pegs A. B. K. J are accurately set, transfer the marking wire to set peg E, which may now be sighted on peg J. A. Repeat the process and set peg F in line with pegs K B. Take the F end of the wire to peg L, which is to be set in the line with K J. Transfer the wire to F. G. Set peg G in line with F E and move the wire to G H and set peg H in line with G E F. Then set the last peg M in line with L K J.

Having completed the 3-ft. pegs, proceed to peg H and sight it first on pegs G F E, then on the diagonal pegs L B, and lastly on pegs M D. If each of these sets of pegs is in perfect line the whole area will be accurately pegged when completely filled in with the small pegs. Next transfer the wire to J K and set the seven short pegs (1 to 7). Repeat the process between K L, L M, H G, G F and F E. This completes the pegging of the three main lines. Now set the wire between pegs A J and fill in the seven small intervening pegs. Repeat the process between 1 1, 2 2, 3 3 and so on until the pegs D M are reached. Cross over to pegs M H and continue filling in until the last row J E is reached. This will complete the whole area. Any size or shaped piece of land may be pegged by this method.

When setting the short pegs (filling in), the marking wire ends must be placed in front of the end pegs already set, and all of the short pegs set on the side opposite to the direction the wire is travelling. This will prevent pegs being dragged out each time the wire is moved.

Distance Apart to Plant Citrus Trees.—Citrus trees should never be planted nearer than 24 ft. apart each way, and this distance applies to all varieties of citrus. If seedling orange trees are to be planted it would be advisable to space them 30 ft. apart owing to the large size to which they will grow. The spacing recommended will provide each tree with sufficient room to grow unhindered, and each tree will have a large root-feeding area. Green crops also will receive more sunlight, and ploughing, cultivation, spraying or fumigation will be made easier.

(*To be continued.*)

Locust Invasion, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 12. November, 1933.

Red Locust (*Nomadacris septemfasciata*).—From the 1st to the 16th of the month a general southerly to south-easterly movement of Red Locust swarms was apparent, and during this period it is judged that the Colony was invaded by fresh swarms from north of the Zambesi River, Northern Bechuanaland and elsewhere, whilst a lesser number of swarms passed from the Colony into the Union of South Africa and Mozambique Territory.

A marked increase in the number of swarms became apparent as the month progressed. In some cases unusual density of formation of flight was noted.

The swarms invading the country from the north were apparently more advanced towards the egg-laying stage than those previously in the Colony, as from the 15th of the month specimens began to arrive at headquarters showing much greater development of eggs than those previously examined. Specimens showing changes towards the yellowish breeding colouration were noted from the 19th and on the 21st the first egg-laying was recorded. By the end of the month egg-laying had been reliably reported from eleven districts and unsubstantiated reports of egg-laying had been received from three more districts.

The present position is that swarms more or less in egg-laying condition are present in practically all districts.

From the entomological standpoint it is interesting to note that Red Locusts kept in cages, which had retained or reverted to the brownish colouration exhibited by this species, when leading a solitary or comparatively inactive life, tended to become black or "Cologne Earth" colour when breeding.

This was particularly noticeable in the females. Similarly coloured specimens were secured in the field at a later date and it is suspected that this may be the natural breeding colouration of the "solitary phase" of this species. In these black individuals the dorsal stripe is a pale brown to pale yellow and the central stripes are indistinct. The abdomen, especially in the males, is yellow.

The difference between these specimens and the breeding colour of the usual swarm type, is very marked.

Parasites.—Specimens examined during the second half of the month have shown an indefinite percentage of individuals infected with small maggots in the region of the fat bodies and ovaries. The adult of these maggots is a small fly, belonging to the family *Tachinidæ*. The effect of infestation with these maggots is apparently destruction of the ovaries. The percentage infestation is appreciable, but owing to the fact that parasitised specimens are probably more easily caught than healthy ones, it is not possible to estimate this percentage on any reliable basis. It does not appear that the work of these parasites this season will be effective in preventing egg-laying on a very large scale.

Winged locusts have been reported as dying in large numbers in certain of the more elevated parts of the eastern border of the Colony.

Tropical Migratory Locusts.—Individual fliers of this species have been found associated with swarms of the Red Locust, considerable numbers apparently being present in some cases. No swarms in which this species predominates are, however, known to be present in the Colony.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

OCTOBER, 1933.

AFRICAN COAST FEVER.

No cases recorded. It was decided to slaughter the cattle on Lindley, Melsetter district, owing to the difficulty in dealing with this separate herd, and destruction was carried out during the month.

TRYPANOSOMIASIS.

Cases occurred on several farms and very heavy mortality on one farm in Eastern Melsetter where poor grazing was a contributory factor.

SCAB.

Several native herds were placed in quarantine.

ANTHRAX.

Several cases occurred amongst fresh cattle introduced to a previously infected area, the remainder were inoculated.

MALLEIN TEST.

Nine horses were tested on importation with negative results.

IMPORTATIONS.

From the Union of South Africa:—Horses 9, sheep 2.

EXPORTATIONS.

Bulls 1, heifers 2.

To the United Kingdom *via* Union ports in cold storage: Fore quarters, 4,608; hind quarters, 4,999; boned quarters, 2,747; livers, 18,747 lbs.; tongues, 11,623 lbs.; hearts, 4,716 lbs.; skirts, 2,236 lbs.; shanks, 5,990 lbs.; tails, 2,448 lbs.; kidneys, 731 lbs.

Meat Products:—Meat meal, 45,464 lbs.; meat extract, 8,948 lbs.; beef fat, 100 lbs.

G. C. Hooper Sharpe,
Acting Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

NOVEMBER, 1933.

Pressure.—The mean barometric pressure for the month was generally slightly below normal.

Temperature.—Maximum temperatures were generally well below normal and minimum temperatures about normal or slightly above.

Rainfall.—A schedule of the daily rainfall is reproduced. The figures refer to telegraphic stations only and the total for the month may differ appreciably from the final figure. The month was excessively wet, except in the extreme North and East, and the total exceeds the previous highest recorded in 1900 by 0.12 inches.

NOVEMBER, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max Min	Normal.	Dry Bulb	Wet Bulb.	%	F.	0-10	Ins	Normal	No. of Days	
Angus Ranch... ...	...	...	105	60	86.6	68.2	77.4	79.7	76.0	68.4	66	64	...	5.65	1.8	15	...
Beit Bridge	963.1	...	105	61	88.0	68.0	78.0	...	75.7	67.0	64	62	6.5	2.84	2.2	10	1,510
Bindura...	890.6	...	96	59	82.0	65.1	73.5	...	72.1	64.5	66	60	5.8	6.40	2.8	11	3,709
Bulawayo	868.1	867.8	90	53	79.5	61.2	70.4	72.6	68.2	61.7	69	57	7.9	4.82	3.2	20	4,425
Chipinga	891.8	...	93	55	77.7	61.5	69.6	...	70.0	64.0	72	61	5.8	8.18	4.2	18	3,684
Enkeldoorn	857.3	...	90	52	78.1	59.9	69.0	70.2	68.5	62.0	69	58	6.4	7.68	3.4	18	4,787
Fort Victoria	894.7	895.0	98	52	81.3	63.4	72.4	72.7	71.6	64.0	66	59	7.0	4.52	2.9	11	3,570
Gwaai Siding	902.5	...	96	60	88.2	64.9	76.5	...	73.8	65.1	63	60	6.2	2.00	2.3	19	3,280
Gwanda	905.1	...	95	54	81.5	63.6	72.5	...	71.2	63.5	64	59	...	5.19	2.2	12	3,228
Gwelo	862.0	...	92	53	80.2	61.0	70.6	73.6	68.5	61.9	69	58	6.1	8.41	3.7	12	4,627
Hartley	885.8	...	96	58	83.5	62.9	73.2	76.4	71.5	63.8	66	59	6.5	5.24	3.5	13	3,878
Inyanga	836.1	...	83	51	74.4	58.6	66.3	...	69.3	60.0	59	54	7.3	4.72	3.7	19	5,513
Marandellas	837.7	...	86	52	75.6	58.1	66.8	...	67.0	60.5	69	56	6.0	5.90	3.7	16	5,450
Miami	878.1	...	93	57	82.1	63.0	72.3	...	71.3	63.9	67	60	6.7	5.51	2.3	16	4,077
Mount Darwin ...	906.3	...	98	59	86.1	65.7	75.9	..	74.9	66.1	63	61	5.9	4.13	3.5	11	3,178
Mount Nuza	801.7	...	80	47	64.4	52.9	58.6	...	58.8	56.5	86	55	7.6	9.70	...	21	6,666
Mtoko	876.7	...	95	57	82.2	63.4	72.8	...	72.0	63.8	65	59	...	3.80	3.3	9	4,140
New Year's Gift...	...	...	101	57	83.8	64.1	74.0	...	72.8	66.2	71	63	...	4.25	3.0	12	2,690
Nuanetsi	960.1	...	106	55	86.5	66.8	76.6	...	76.6	68.5	67	65	6.1	3.83	2.9	11	1,650
Plumtree	863.3	...	89	55	80.0	61.7	70.9	...	69.8	61.6	62	56	5.6	8.83	...	18	4,549
Que Que	881.0	...	94	56	83.9	63.7	73.8	..	72.9	64.1	61	59	4.9	9.05	2.8	13	3,998
Riverbank...	...	...	98	55	84.7	63.1	73.9	76.5	70.0	62.5	66	58	...	4.42	2.2	18	4,090
Rusape...	861.5	...	89	52	78.0	59.9	69.0	...	68.6	61.7	67	57	8.0	4.62	4.8	15	4,630
Salisbury	854.3	854.9	91	54	79.1	60.0	69.6	71.9	69.7	61.8	66	57	...	9.29	3.3	17	4,885
Shabani	906.5	...	97	57	82.6	64.9	73.8	...	71.8	64.8	69	61	7.8	7.09	1.4	15	3,192
Sinoia	887.1	...	94	54	83.4	63.3	73.3	...	73.2	64.6	63	59	6.0	5.70	3.2	18	3,793
Sipililo	884.0	...	92	59	83.1	64.7	73.9	...	74.2	64.2	58	59	4.4	1.96	3.3	6	3,875
Umtali...	892.8	893.2	96	56	79.2	62.5	70.8	72.6	70.1	64.9	76	62	6.9	5.00	3.7	16	3,670
Wankie	925.3	...	98	62	90.2	70.0	80.1	...	77.7	67.9	60	62	5.4	4.91	2.0	11	2,566

Rainfall in November, 1933, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total
1	...	20	19	11	...	...	...	...	32	20	15	9	...	...	...	11	2	11	39	67	42	35	89	68	12	23	17	67	3	...	612
2	..	7	9	12	1	...	...	...	72	...	8	1	...	...	...	1	1	32	20	28	54	11	125	143	39	9	1	19	28	1	622
3	...	...	16	23	29	1	...	...	34	1	15	5	...	...	...	3	...	...	...	...	361	26	123	25	90	4	1	8	53	...	818
4	15	5	3	9	..	...	...	...	89	18	14	15	...	...	...	12	8	30	8	26	5	137	135	67	115	27	11	48	2	6	805
5	...	10	7	36	11	...	5	...	9	4	...	66	8	...	44	18	37	23	117	16	20	11	31	26	7	71	42	28	53	15	715
6	...	11	1	49	19	...	...	...	72	1	5	53	1	4	4	6	...	23	110	6	21	67	17	38	94	102	...	40	30	37	811
7	...	2	30	28	42	...	...	...	139	10	27	19	9	3	16	5	8	4	15	1	28	1	23	63	11	35	6	29	18	8	580
8	...	...	...	3	98	29	...	...	68	11	2	6	3	1	22	...	1	16	24	...	39	80	3	116	...	15	...	18	...	28	583
9	...	6	...	3	18	17	...	...	13	...	3	32	...	3	2	...	14	27	26	24	7	69	12	107	..	61	...	...	...	29	473
10	...	...	9	3	3	...	...	...	74	20	1	14	...	...	...	...	...	35	11	...	69	27	17	107	...	...	...	...	...	15	405
Mean	1	9	10	17	15	4	1	—	53	9	9	25	3	1	11	7	11	21	44	26	34	39	59	78	25	39	13	31	18	12	625

Farming Calendar.

JANUARY.

BEE-KEEPING.

This month is a slack one for actual hive work Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds Cover or green crops may be planted during this month: if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly This will assist in smothering future weed growth Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS

Continue planting cover or green crops between the trees These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other: suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once. such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done. push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL

Maize.—Late planted maize, particularly crops planted after the New Year are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol use at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanimycus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant. or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to

employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Warm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, August, 1933.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928 The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.- Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead 1 lb in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning wih a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.)—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in

the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit:—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2½ lbs.; water. 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check The soil requires constant stirring. owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon a they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground. thus preventing water seeping in and making it damp The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs

Some of the birds will now be in moult To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb), also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran and give about one desert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range

Ducks must be treated in almost exactly the reverse manner to what turkeys are They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i e.*, they should practically be allowed to spend their existence eating and sleeping Big duck breeders often give a fourth meal by lamplight at 10 p m , and the first meal is given at sunrise.

STOCK

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence Cows rearing calves should not be milked more than once a day Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and "rotate" the grazing as much as possible Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, *i.e.*, a cow producing three gallons of milk should receive 6 to 7 lbs. of

concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect, nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

FEBRUARY.

BEE-KEEPING

In most part of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, *i.e.*, to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month. and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See *Rhodesia Agricultural Journal*, December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad. sometimes causes considerable wilting of the crop besides attacking tubers The ladybirds may be destroyed by spraying with arsenate of lead 1lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of goards. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb , 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur. dianthus and pentstemon. The flower garden should be now looking its best, nearly all

plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, *i.e.*, pines, cypresses and calitris, and seed of these species should be sown for the following season's planting.

GENERAL

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition. but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing It pays far better to get rid of all of the latter, even if only at 1s. or 1s 3d per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand. etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk, are the chief reason sfor non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially

in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition, and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or luke warm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheese-making, and great care should also be taken of the starter. If this latter shows any signs of gassiness or develops any diagreeable flavour or colour, it hould be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

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TOBACCO

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Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Farmers' Day at Matopo.—A most successful Farmers' Day was held at Matopo School of Agriculture on January 18th. About one hundred farmers attended the lecture and demonstration given by Mr. C. A. Murray, M.Sc., Animal Husbandry Officer, and the Department was represented by the Director and the Chief Animal Husbandry Officer. A comprehensive series of feeding experiments has been carried on for some time, dealing mainly with young stock and bullocks for export. About a dozen experimental groups were exhibited comprising about 150 head and the results of both mineral and protein supplements was demonstrated. The groups which attracted the greatest amount of attention were those illustrat-

ing the preliminary feeding of steers grazing during the day on ordinary veld, in preparation for more intensive topping off in the near future. These animals were of particular interest, because it has been stated generally by farmers that it is impossible to get animals to feed on concentrates when there is an abundance of green grass. Mr. Murray pointed out that under present grazing conditions the fattening of cattle could be carried out more cheaply than at any other time of the year, and that it was perfectly simple to balance any reduction in the feeding value of the veld towards the end of the rainy season by increasing the amount and nature of the concentrates fed.

Experimental Consignment of Frozen Porkers.—Some very good porkers for export have been sent to Bulawayo for slaughter during this month, and it is anticipated that a consignment of from ninety to one hundred suitable pigs will be selected without trouble. The porkers will be railed from Bulawayo to Cape Town on January 29th and consigned to the Stockbreeders'' Meat Company, Smithfield, which handles the Rhodesian chilled beef.

The rate of gain in weight of the pigs on the rations laid down has been so good that it took the farmers by surprise, and a number of pigs were thus marketed overweight. Consequently it will be necessary to make a grade of from eighty to one hundred pound porkers in the consignment as well as the desired one of sixty to eighty pounds.

A full report of this experiment will be published in this journal in due course.

Ephestia in Rhodesian Tobacco.—It is gratifying to learn that the investigations in London into the infestation of Rhodesian tobacco by *Ephestia* are still continuing. A report has just been received by Mr. F. R. Passmore, Entomologist on

the Staff of the Imperial College of Science and Technology, relating to a survey he has undertaken in connection with Rhodesian tobacco in the London Docks Warehouse during the period June to November, 1933.

This survey was undertaken with a view to ascertaining whether Rhodesian tobacco infested with *Ephestia elutella* is being imported into London, and if so, where the insects originally get into the shipments.

It was observed that throughout the whole period of the survey no newly imported Rhodesian tobacco infested with *Ephestia elutella* has been seen nor has its occurrance been reported by the warehouse samplers, except erroneously in two instances when the insects proved to be *Ephestia cautella.*

In two instances pupæ and dead adults of *Ephestia cautella* were found in consignments in such numbers as to cause alarm during sampling. In two other ships live *Ephestia cautella* adults were found among the bales of tobacco, but were not seen after it had been landed.

In the same holds as all of these consignments were East African ground-nuts, which Mr. Passmore states were with little doubt the source of the infestation.

Mr. Passmore goes on to say that *Ephestia cautella* cannot, so far as is known, live on tobacco, and except that they were mistaken for *Ephestia elutella* infestation at the warehouse, these instances are unimportant in themselves. He points out, however, that as *Ephestia elutella* has been reported in ground-nuts from various parts of the world the indications are that a better understanding of the insect pests of products which are shipped with tobacco might be valuable, as there would seem to be a potential danger of tobacco infestation originating from shipment in the same holds as such produce.

Insulin for Underweight Animals.—During the last three years a considerable amount of investigation work has been

conducted in different parts of the world concerning the effects of insulin on the growth of animals. Insulin is not a food nor a drug but belongs to a group of substances known as hormones which play a most important part in the functioning of the animal body. About forty years ago it was first observed that the removal of the pancreas from dogs immediately caused severe diabetes, and it was later discovered that certain "islands" or groups of cells associated with the pancreas secreted a substance which was essential to maintain normal health, and to this substance the name Insulin was given. Means have been devised to extract insulin from the pancreas of freshly slaughtered animals and of purifying it so that it can be diluted and injected into human beings or animals suffering from diabetes with beneficial results. To control the effectiveness of insulin it has been usual to test its effect on rabbits and a number of workers noted that most of the animals, during the first few weeks of treatment, put on weight very rapidly. It has also been noted that most diabetic patients who are allowed a liberal diet with sufficient insulin treatment to prevent the blood sugar becoming high put on weight rapidly. Recent investigations seem to indicate, howevery, that in more or less normal animals the increase in weight with insulin treatment can be accounted for by increased appetite rather than from direct action of the insulin. In backward, and undersized young animals, however, this effect on the appetite may play an important part, and even in the absence of any diabetic condition may quickly restore a backward animal to an average normal state.

Spineless Prickly Pear for Livestock.—Although it was shown a few years ago that sheep could be kept alive on prickly pear and lucerne hay for a long period, it was also demonstrated at the end of the experiment that the feeding of even spineless prickly pear was accompanied by danger. This was due to the tiny spicules which occur in large numbers in the small depressions of the so-called leaves and fruit and which are so well protected that it is almost impossible to remove them. These spicules are most numerous on the

so-called spineless varieties of prickly pear. They are extremely irritating because of their small size and the fact that they are barbed in such a way that they cannot be removed. In the Graaff-Reinet experiments a number of the sheep died from the effects of spicule irritation and 40 per cent. of the lambs died from the same cause. The most interesting information obtained from the experiments was that although the majority of the sheep used were known to be severely infested with worms of various kinds, including nodular worms, they all became entirely free soon after the experiment started. Prickly pear is known to be an effective purgative, and it would appear that it is also a very effective vermifuge.

Bounty on Chilled Beef.—In accordance with notices previously published, it is the intention of the Government in future to limit the payment of the bounty to chilled meat derived from suitable stall-fed cattle. It has become apparent, however, that owing to the short notice given of the decision, there may be some difficulty in securing sufficient stall-fed animals during the next few months to maintain adequate shipments, and the Government, therefore, has decided that, in addition to a bounty of three farthings per pound dressed weight on suitable stall-fed cattle, a further bounty of one half-penny per pound dressed weight will be payable on first quality grass-fed cattle from February 1 until the end of April. This one halfpenny per pound bounty will be definitely restricted to special grass-fed steers which reach a standard of quality approved by the Department of Agriculture, and passed after slaughter as suitable by the Government Inspectors. Subsequent to April 30 next, the bounty will definitely be restricted to stall-fed cattle as already announced.

Rhodesia Tobacco Association: Results of Elections for Executive.—The following are the results of the elections for the Executive of the Rhodesia Tobacco Association. As Area No. 2 is allowed three representatives only, it will be necessary to hold an election in that area to choose between Messrs. Field and Wise, who tied:—

Area No. 1.—R. D. James.

Area No. 2.—A. M. Hutchinson, O. C. Rawson, *W. J. Field, *P. A. Wise. *Tie.)

Area No. 3.—H. J. S. Philp.

Area No. 4.—N. J. A. Jordaan.

Area No. 5.—H. S. Andrews (unopposed).

Area No. 6.—W. A. Ludgater (unopposed).

Area No. 7.—M. D. Claxton.

Area No. 8.—H. Collard Hards (unopposed).

Area No. 9.—J. Beckingham.

Area No. 10.—J. R. V. Brown.

Area No. 11.—Major L. M. Hastings (unoposed).

Area No. 12.—H. K. Scorror (unopposed).

Area No. 13.—J. P. de Kock (unopposed).

Area No. 14.—A. L. Curling.

Area No. 15.—E. R. Etheridge (unopposed).

Area No. 16.—R. D. Palmer.

Area No. 17.—C. W. Fenton-Wells (unopposed).

Area No. 18.—W. B. Wilson (unopposed).

Economical Winter Rations for Wintering Dairy Heifers.

By C. A. MURRAY, M.Sc. (Agric.),
Lecturer in Animal Husbandry, Matopo School of Agriculture.

Dairy calves, both before and after weaning, are often much neglected. (1) The large number of undersized, undernourished, "pot-bellied" and unthrifty calves to be seen on many farms is convincing proof of this fact.

Dairy calves are usually weaned when they are about six months old. After weaning, the common tendency is to neglect them, as they are considered to have passed the calf stage and are thought old enough to partly rough it for themselves. The result of this practice is stunted cows with limited production.

During the summer months on good green grazing the weaners can take good care of themselves, but during the winter months they will be severely stunted unless they receive some supplementary feeding.

In order to get further information on the suitability and economy of different rations for wintering yearling dairy heifers, a trial was conducted at the Matopo School of Agriculture during the period July to December, 1933.

Animals Used—Two similar groups of grade Friesland heifers were used. In each group there were seven heifers varying in age from 8 months to 16 months.

Rations Fed.—The following rations were fed daily to the two groups:—

Group 1.

4—8 lbs. maize stover.
6—10 lbs. maize silage.
1 lb. peanut meal.

(1) Full particulars on "Hand-rearing of Calves" are given in Bulletin No. 873 obtainable from the Department of Agriculture, Salisbury.

Group II.

2—5 lbs. maize stover.
6—10 lbs. maize silage.
4—5 lbs. cowpea hay.

Feeding and Management.—By the end of July it was noticed the heifers intended for this experiment could no longer maintain their condition on the veld and this trial was consequently started on the 26th of the month.

The two groups of heifers were run in two small convenient 3-acre paddocks without any grazing. Each paddock was provided with a 12 foot wood-and-iron manger in which the dry roughage could be fed.

Every morning, at about 8 a.m., the animals were brought to the stables and each heifer received separately her ration of silage and peanut meal (Group I.) or silage only (Group II.). When finished they were taken back to the paddocks and given their dry roughage. Group I. received maize stover only and Group II. maize stover and cowpea hay. Both the maize stover and cowpea hay, in order to minimise waste, were cut up before feeding.

Growth.—Table I. gives particulars concerning the growth of the two groups of heifers.

Table I.

	Group I.	Group II.
Number of heifers per group	7	7
Average Initial Weight on 26/7/33...	411 lbs.	417 lbs.
Average Final Weight on 15/11/33 . .	498 lbs.	538 lbs.
Average Total Gain in Weight	87 lbs.	121 lbs.
Average Daily Gain in Weight	.79 lbs.	1.1 lbs.

In view of the fact that growing animals making large winter gains do not make such large gains in the subsequent summer as those making smaller winter gains, it is econo-

GROUP I.—Maize Stover, Silage and Peanut Meal.

GROUP II.—Maize Stover, Silage and Cowpea Hay.

mically undesirable to feed young stock heavily during the winter months. A winter gain of approx. 50 lbs. is usually considered quite satisfactory for yearlings.

From Table I. it will be seen that the Group I. heifers gained on the average 87 lbs. and the Group II. heifers 121 lbs. during the wintering period, *i.e.*, an average daily gain of .79 and 1.1 lbs. respectively. From a growth point of view it appears therefore that Ration II. was the more efficient. It is considered, however, that at least part of the increased gains made by Group II. over Group I. was due to the fact that two of the heifers in Group II. turned out exceptionally thrifty animals and gained very much more than their corresponding mates in Group I.

The gains made were considered very satisfactory, and at the conclusion of the trial experienced cattle judges were of the opinion that the condition, thriftiness and general appearance of both groups of heifers were very satisfactory when considered from the standpoint of good dairy herd management.

Feed Consumption.—Particulars of the feed requirements and the cost of wintering the two groups of heifers are given in Table II.

From Table II. it will be noticed that the average daily food allowances were comparatively small. The Group I. heifers received on the average 7.8 lbs. of stover, 8.6 lbs. of silage and 1 lb. of peanut meal, whereas the Group II. heifers heifers received 7.4 lbs. of stover and cowpea hay (2.7 lbs. stover and 4.7 lbs. cowpea hay) and 8.6 lbs. of silage.

Taking into consideration the small amounts of feed consumed and the excellent gains made, the two rations proved *very* satisfactory for the wintering of young dairy heifers.

The total feed costs, after allowing reasonable values for home-grown feeds and market values for purchased feeds, amounted to 17/6 for Group I. and 14/1 for Group II. Ration II., therefore, not only produced better growth than Ration I., but was also more economical to feed. This very forcibly demonstrates the necessity for growing and feeding home-grown feeds.

Table II.

	Group I.			Group II.		
	Maize Stover. lbs.	Maize Silage. lbs.	Peanut Meal. lbs	Maize Stover. lbs.	Maize Silage lbs.	Cowpea Hay. lbs.
Average daily consumption per heifer...	7.8	8.6	1	2 7	8.6	4.7
Total consumption per heifer..	868	959	111	294	959	516
Average feed cost per heifer ([1])	4/4	4/10	8/4	1/6	4/10	7/9
	Total	17/6			14/1	

Conclusions.—From the results of the trial the following conclusions are drawn:—

1. The two rations tested out proved both efficient and economical for the wintering of yearling dairy heifers.

2. Ration II., consisting entirely of home-grown feeds, was equal to or better than Ration I., both from the standpoint of growth and the economy.

3. The advisability of growing and feeding home-grown feeds, especially legume hay, was clearly demonstrated.

It is hoped that the information obtained from this trial will encourage dairy farmers to take better care of their young growing stock during the winter months and so build up herds of well-grown, high producing dairy cows.

Acknowledgements.—I am indebted to Dr. Haylett, Director Rhodes Matopo Estate, for providing the necessary facilities for carrying out the trial, and to Dr. A. E. Romyn, Senior Animal Husbandry Officer, Department of Agriculture, for suggestions during the course of the trial and with the preparation of this short report. My thanks are also due to Mr. R. H. Greaves, Stockman, for regularly weighing the animals and supervising the feeding.

([1]) Maize stover 10/- per ton, Maize silage 10/- per ton, Cowpea hay 30/- per ton, Peanut meal £7 10/- per ton.

The Germination of Paspalum Seed.

By GEO. A. GILL, Botanist, School of Agriculture, Cedara.

[NOTE.—Geo. A. Gill, Lecturer in Botany at the Cedara School of Agriculture, has paid particular attention to the germination of various grass seeds, including Paspalum. The following extracts are taken from reports published by Mr. Gill in *Farming in South Africa*, and will undoubtedly prove of interest to many of our readers. —Ed.]

In the January, 1932, issue of *Farming in South Africa*, the results of certain germination tests carried out on Paspalum dilatatum seed were reported. These seemed to throw some light on the sometimes apparently erratic germination of paspalum seed under field conditions, and the opinion was expressed that a maturation period was required before paspalum seed attained its maximum possible germination. This opinion has now been confirmed as the result of systematic monthly tests covering the period October, 1931, to October, 1932, and carried out on a representative sample of imported Australian seed. Each test was conducted for a period of 21 days, and the monthly total average germinations obtained were as follows:—

1931: Oct., 1 per cent.; Nov., not tested; Dec., 1 per cent.; 1932: Jan., 1.5 per cent.; Feb., 5 per cent.; March, 11.5 per cent.; April, 13 per cent.; May, 20.5 per cent.; June, 19 per cent.; July, 19.6 per cent.; August, 29.6 per cent.; September, 27.6 per cent.; October, 32.6 per cent.

The seed used in the test was from the 1931 crop, and was presumably collected about February or March, as the best Australian seed is not collected earlier than this. It is interesting to observe that the germination must have remained at 1 per cent. or lower for fully nine months before an increase in germination occurred in January of the follow-

ing year. Thereafter, a steady increase was noted until May, when an approximate germination of 20 per cent. had been obtained. During the three winter months the germination remained constant, to be followed by a sudden leap of 10 per cent. in August, a surprising but interesting result, coinciding as it does with the advent of spring. The germination had increased to about 33 per cent. in October, 1932, when the last available figure was obtained, and had then presumably not yet reached the maximum. The monthly germination tests will be continued until this maximum has been attained, and then still further, to ascertain the rate at which germination diminishes.

Judging by annual tests which have been carried out on other samples, as definite improvement in germination is to be expected even during the second year after collection. In this connection the following data are available:—

Sample.	Date Tested.	Result.
		%
Australian	Sept., 1930	1.0
	Oct., 1931	35.0
	Oct., 1932	44.5
South African... ...	Oct., 1930	Nil.
	Oct., 1931	8.5
	Oct., 1932	11.0

In the above cases the Australian seed shows an improvement of 27 per cent., and the South African seed an improvement of 29 per cent. during the second season after collection. Here, then, we have seed at least 2½ years old which has steadily improved in germination. As yet, the turning point where the seed begins to lose its germinating power through old age is not known.

Age and Rate of Germination.—Another important feature observed is the relative rate at which germination proceeds in samples of seed of different ages. Thus the 1¼-year-old Australian sample germinated 50 per cent. of the total germi-

nation during the first six days of the October, 1932 test, and the other 50 per cent. during the remainder of the 21 days. Corresponding figures for the 2½-year-old sample are 94 per cent. of the total germination during the first six days, and only 6 per cent. during the remainder of the test. This would indicate that 2½-year-old seed is more satisfactory from every point of view; it has a higher total germination than fresher seed, and also germinates much more rapidly. Under field conditions seed of this condition would ensure rapid establishment, rendering less likely losses owing to a dry spell following germination, and favouring the grass in competition with the annual grasses and weeds that usually come up abundantly at the time of sowing.

In buying Paspalum dilatatum seed the recommendation would thus be to choose old seed collected a couple of seasons previously in preference to freshly collected seed, as a more satisfactory article is thus likely to be obtained. A germination test, however, would still be essential to discover the true value of any particular sample. Seedsmen and farmers who collect paspalum seed for sale can rest assured that any old stocks not disposed of during the season following collection will improve and not deteriorate in quality for at least two to three years after collection.

The results obtained throw light on the sometimes erratic behaviour of Paspalum seed under field conditions where it may germinate very much better than the laboratory tests would seem to warrant. Cases have also been brought to our notice where a Paspalum pasture sown during the summer rains has not produced a single visible plant before winter. After the following spring rains, however, very satisfactory germination has occurred. Thus if no immediate results are obtained after sowing Papsalum, it is advisable to wait for a considerable while before concluding that it is a failure.

SCREW - WORM.

A PEST OF RANCH CATTLE IN SOUTHERN RHODESIA.

By A. Cuthbertson, Entomologist.

FOREWORD: By R. W. Jack, Chief Entomologist.

The so-called "Screw-worm" problem has become one of major importance to the ranching industry in Southern Rhodesia during the past fifteen or sixteen years.

In the *Rhodesia Agricultural Journal*, December, 1918, the writer published the first note of the occurrence of a fly, identified later as *Chrysomyia bezziana*, Villen, as the cause of *myiasis* in cattle in this Colony, and subsequent to that date repeated rearing of flies from cases of Myiasis has demonstrated clearly that this species is the one mainly concerned with the production of the disease in cattle in Southern Rhodesia. A further note appeared in the *Rhodesia Agricultural Journal*, May, 1926.

The term "Myiasis," it should be explained, is applied to the disease produced by the infestation of the tissues of vertebrate animals by the larvæ (maggots) of flies. The term "screw-worm" has been taken over from the United States of America, where it was originally applied to the maggots of a related fly *Cochliomyia macellaria* Fab. causing a similar disease.

C. bezziana has been recorded as the cause of myiasis in man and animals in India, the Phillipines, elsewhere in the East and in Tropical Africa. It occurs in the Union of South Africa, but is not recorded as of primary importance, except in the Northern Transvaal. Elsewhere in the Union other specimens of "Blow-flies" constitute a serious problem in respect to myiasis in sheep.

In Southern Rhodesia *C. bezziana* has been identified by Mr. Cuthbertson as the cause of myiasis in cattle, sheep, horses and dogs, but sheep at least are also attacked by other species of blow-flies as in other parts of the world. The maggots of this species were also identified in one case of human myiasis (a native).

The problem created by *C. bezziana* is a very difficult one. Unlike other "blow-flies" this "blue-bottle" is not known to breed in carrion or elsewhere than in the living tissues of domestic animals, although it very probably breeds in wild game if seriously wounded. It appears to be entirely parasitic. Consequently, traps baited with carrion as used against other "blow-flies," are altogether useless in reference to its control, and indirect measures, such as disposal of carcases, are not applicable to this species. Shade traps as used in Zululand against the tsetse fly, *Glossina pallidipes*, Austin, have also given negative results. These were tested because of observations indicating that *C. bezziana* is, to some extent at least, a forest loving, and, therefore, probably a shade-loving insect. Cattle in wooded country are apparently more liable to attack than cattle in more open surroundings.

Mr. Cuthbertson's studies of the habits and life economy of *C. bezziana* appear to indicate a very close association between the fly and its hosts. The adults of this species have been regarded as very difficult to observe in the field, in fact, Patton* states "The adult can *only* be obtained by breeding them out from larvae collected from cases of myiasis." Actually, Mr. Cuthbertson has observed and collected the females comparatively freely at wounds in cattle, and has observed the males feeding on the surface liquids of fresh cowdung, on the "honey-dew" on grasses infected with *Ergot*, and also at flowers (*Gymnosporia* sp). Flies of both sexes have also been observed emerging from the soil at the cattle mustering pens. The process of egg-laying in wounds has been watched, and the duration of the different stages of the life cycle recorded.

Nothing observed in connection with the habits of this species has, however, indicated any line along which to work

*"Insects, Ticks, Mites and Venomous Animals," Pt. I.: Patton & Evans. 1929, Liverpool School of Tropical Medicine.

in the direction of novel methods of control, and Mr. Cuthbertson has, therefore, been forced to direct attention to ascertaining the most important of the original causes of infestation and to testing various methods of treating wounds with the object of preventing re-infestation and causing quick healing.

The most important of the primary causes of "screw-worm" attack seems to be wounds due to the Bont-legged Tick (*Hyalomma ægyptium impressum* Koch), and there can be no doubt that better control of this tick would result in reduction of the incidence of screw-worm. Unfortunately the Bont-legged Tick is markedly resistent to dipping, and is particularly difficult of control, because it passes its immature stages on birds and rodents, and not on domestic animals, thus escaping dipping during the more vulnerable period of its life.

The greatest difficulty in reference to the healing of wounds lies in the lack of effective antiseptics against the anærobic bacteria of screw-worm wounds. These bacteria produce gases with a characteristic odour, which is highly attractive to the female flies in reference to egg-laying, and this odour cannot be altogether disguised by known repellent substances. Consequently wounds once infested are very subject to reinfestation, and healing is, of course, delayed in any case. This appears to be a point deserving of further research from the veterinary side.

In conclusion, it may be stated that theoretically it should be possible to control screw-worm by prompt attention to all cases and destruction of the maggots. This is based upon the apparent fact that the flies can only breed freely in domestic animals and are, therefore, dependent for increase mainly on neglected cases of the disease. In practice it appears that on farms where the cattle are comparatively few in number and are under close observation, "Screw-worm" does not constitute as serious a problem as under ranching conditions.

The following article contains certain references to proprietary preparations. It has seemed impossible to avoid this without detracting greatly from the value of the report, as there are many such preparations on the market and several have necessarily been tested for one purpose or another during

the investigation. The statements in reference to these apply only to the results of the actual tests made, and further information regarding their use will be supplied on application.

It may be mentioned that some six hundred cases of the disease were utilized for the purpose of the tests on which this report is based.

The habits and life history of the Blow-flies and the Screw-worm Fly *Chrysomyia bezziana* (Vill.), were studied in recent years at Glass Block Ranch, near Balla-Balla, and some notes were published in the *Proceedings of the Rhodesia Scientific Association*, Vol. XXXI., p. 35 (1932), and Vol. XXXII., pp. 94-100 (1933). The subject of *Myiasis* (*i.e.*, the infestation of wounds with Dipterous larvæ) will be discussed in the *Rhodesia Agricultural Journal* in the near future.

The following tentative recommendations are mostly based on observations and experiments made by the writer at Balla-Balla. A considerable amount of research on the etiology of myiasis in cattle, particularly with reference to the Bont-legged Tick, (*Hyalomma ægyptium impressum* Koch), and on the bacteriology of screw-worm infested wounds, remains to be carried out.

The fly belongs to the blow-fly group, and was first noted as a serious pest of cattle in the Mazoe Valley some 15 years ago. Since that time it has been reported throughout the Colony, especially on thickly forested ranches in the Umtali, Charter, Mzingwane and Bulawayo districts. In open grassy country with sparse bush, *e.g.*, around Daisyfield and Enkeldoorn, the fly is much less prevalent.

Grateful acknowledgement is made to the Director of Veterinary Research, Salisbury, and Dr. G. R. Ross, of the Bulawayo Pasteur Institute, for suggesting various dressings, most of which have been tested.

CONTROL MEASURES.

Elimination of the Causes of Wounds:

(1) *Hand dressing against Ticks.*—The Bont-legged Tick is responsible for a large number of wounds in cows and young stock during the period November to February. The regular 5 or 7-day dipping is not sufficient to control the tick, and should be supplemented by hand-dressing in December before the ticks become too abundant under the tail and in the perineal region. A suitable dressing for this purpose is composed of Stockholm tar ½ gallon added to a solution of 2½ lbs. resin, ½ lb. caustic soda in 2½ or 3 gallons of water. The undiluted Stockholm tar may be used against clusters of ticks.

Gross infestation of ticks in the ears of calves and heifers occasionally causes wounds. A mixture of Stockholm tar, cotton seed oil and turpentine in the proportion 2:2:1 may be used to control them.

(2) *Accidental Causes.*—Many large wounds are due to injuries sustained in the dipping pens and crush pens. These pens should be kept in good repair. Poking during mustering is the cause of large wounds in the hindquarters and flanks of cows and steers. The practice of dehorning calves should be carefully performed with a copper "Burning-Iron," or other modern mechanical means. Caustic soda should be used only in *dry* weather.

A "baler" or other mechanical means should be used to hold the animal during the treatment of wounds. Carbon di-sulphide should not be used, as the extreme pain it causes makes the animals struggle fiercely to escape from the crush pens, often resulting in further damage to themselves.

(3) *Ear-marking, Dehorning, Castrating and Branding.*—As far as possible these operations should be carried out during the occasional brief spells of dry weather which occur in the summer; small bleeding cuts in the ears after "marking" and injuries to the scrotum during castration should be treated at once with tincture of iodine and Stockholm tar. Dehorning should be performed when calves are two or three weeks old, and the wounds so caused should be immediately dressed with some tarry substance.

Faulty dehorning results at a later date in abnormal growth, the downward growing horns usually piercing the cheek near the eye. A powder composed of iodoform, boracic acid and flour in the proportions 1:2:8 may be applied as a dust for drying the scars near the eyes.

Branding too deeply is sometimes a cause of wounds in the neck and other parts of the body. Carron oil should be used to smear over the newly-burned areas where such accidents occur, the oil acting as a soothing agent.

(4) *Abscesses.*—"Burst Abscesses" on the fleshy parts of the hindquarters of cows and heifers are frequent sources of large wounds, and seem to be the result of the introduction of a toxic substance by the Bont-legged Tick. The abscesses should be treated with undiluted "Kerol," followed by a dressing of Stockholm tar. Rough surgical treatment is often necessary in such cases, as the wounds must be cleaned before applying the dressings.

Other forms of abscesses have been found, notably in the region between the pin-bones and the tail-head of cows and steers. These abscesses are very difficult to heal and are repeatedly re-infested with eggs of the fly. The Veterinary Department is now giving attention to abscesses of this kind, and it is hoped that their nature will be discovered and a method of treatment devised.

(5) *Verminosis.*—Yearling or "weaner" heifers in poor condition in the early wet season show very slight resistance to the effects of myiasis. The poor condition is commonly caused by gross infestation with intestinal worms at a time when the animals have to depend for the first time on grazing for their nutritional requirements. The natural pasture in Southern Rhodesia generally is deficient in certain essential mineral constituents such as chlorine, iron and phosphates. Consequently a "salt lick" composed of salt, bone meal and a little iron oxide should be supplied, particularly to young stock.

The advice of the Veterinary Department should be sought and followed for the treatment of intestinal parasites of young stock, especially heifers.

Destruction of Egg-masses and Larvæ:

Egg masses in or around wounds should be removed with a clean sharp knife. Since the Screw-worm Fly breeds only (or mainly) in the living tissue of domestic animals such as cattle and sheep, and not, as far as known, in carrion or wild ungulates, it is of the utmost importance in control to *destroy every maggot removed from wounds.* Unless this is done thoroughly the immediate neighbourhood of cattle kraals where cases are treated becomes an important centre of infestation.

The maggots *in situ* should be sprayed with ordinary commercial benzol (not pure benzine) which has a marked styptic effect on the wounds. When *all* the larvæ have been removed by means of forceps, the semi-liquid tissues should be surgically removed until the healthy flesh is exposed, and the interior of the wound disinfected. Undiluted "Kerol" has been found to be satisfactory for this purpose when applied by means of a short round brush, but not more than one or two applications should be made, as this substance is extremely caustic, destroyinig the tissues if used repeatedly as a dressing.

Carbon bi-sulphide, petrol, paraffin, Eucalyptus oil and several proprietary remedies have not given satisfactory results in tests made. A certain "Blow Fly Oil" is an effective larvicide, but it is expensive.

REPELLENTS.

When all the maggots have been taken from the wound and the latter has been treated with an antiseptic, a repellent substance should be smeared in and around the wound to repel egg-laying flies. Most of the repellents sold for this purpose are products of the destructive distillation of coal or wood, *e.g.*, Stockholm tar. They derive their repellent properties principally from the phenols and cresols which they contain.

(1) *Stockholm Tar.*—Good quality Stockholm tar should be smeared thickly in and around the wound at intervals of three days. If the wound becomes re-infested with eggs, the latter should be removed immediately and fresh tar applied.

The skin around the wound remains soft under this treatment. Two or three ozs. of "Kerol" added to 4 gallons of tar has been found in practice to improve the dressing.

(2) *Screw-worm Remedy.*—Samples supplied by the manufacturers were tested but the results were not as satisfactory as other dressings which have been tested, principally due to the fact that the mixture soon dropped off the wound, particularly when the latter was situated on the underside of the animal. This proprietary substance is an effective repellent for at least 8-10 hours, *i.e.*, while it adheres the wound. It seems to have a marked soothing effect on raw wounds.

(3)*Pine Tar Oil.*—Samples of a pine tar oil were tested. This oil has been used elsewhere for the treatment of maggots in the soiled wool of sheep. The oil adheres for a longer time to the wound than several other remedies tested, and moreover it does not harden or burn the skin. It is, however, expensive for use on ranches.

(4) A proprietary article which is a coal tar product used extensively as a wood preservative has been used in the Umtali district on screw-worm wounds. It is an effective repellent and sticks strongly to the wound. It is very caustic in action to delicate multiplying cells, and since it also tends finally to harden and thicken the skin around the treated areas, it is not altogether satisfactory.

A number of other proprietary substances sold as remedies were tested, but apparently had little repellent or healing effect.

HEALING AGENTS.

A number of combinations of healing powders in general use in medical and veterinary practice were tested.

(1) *Iodoform and Boracic Acid.*—A powder or "dust" composed of iodoform and boracic in the proportion 1:2, was recommended by the Veterinary Department, but it is too expensive for use on ranches where overhead costs have to be kept to a minimum. The Director of Veterinary Research

suggests that a cheaper "dust" may be made up by the addition of eight parts of flour or starch or sodium bicarbonate to this dust.

(2) *Boracic (or Zinc oxide) and Lime.*—Lime is advocated by some veterinarians in Southern Rhodesia. In South America it is said to have been used successfully in the treatment of myiasis caused by a related fly *C. macellaria.* A dust composed of slaked lime, zinc oxide and iodoform in the proportions 16 : 4 : 1 was tested. It was found to be especially suitable for healing large open "wet" wounds on the flanks and crutch of yearling heifers.

Boracic acid substituted for zinc oxide gave equally good results in the majority of cases where it was tried.

(3) *Zinc oxide and Potassium Alum.*—This effective but rather expensive powder is composed of a mixture of potass. alum, zinc oxide, boracic acid and camphor in the proportions 14 : 10 : 5 : 1. A somewhat similar powder has been used in India for treating cases of human myiasis.

HEALING OINTMENTS AND OILS.

Some ointments, pastes and oils have been tested, but on the score of expense their use under ranching conditions is considered to be limited.

(1) *B.I.P.P. Paste.*—During the war this paste was used as a dressing for wounds. It is composed of equal parts of iodoform and bismuth subnitrate, made into a thick paste with liquid paraffin. Beneficial results were observed after several applications to deep-set wounds which resulted from "burst" abscesses.

(2) *Dyes: Brilliant Green and Gentian Violet.*—At the suggestion of Dr. G. R. Ross, of Bulawayo, some ointments composed of brilliant green and gentian violet were tried. These dyes were used extensively for the treatment of superficial shell wounds, malignant growths and other lesions during the war.

A 1 per cent. solution of the dye combined with glycerine, used as a spray, proved to be an effective disinfectant for small freshly-infested wounds.

Further experiments will be carried out with these and related substances as opportunity offers.

(3) *Carbolic Oil.*—This is not an effective disinfectant for screw-worm infested wounds. Large shallow suppurating wounds were easily cleansed by applying this oil, and for such wounds it acts as an antiseptic.

(4) "*Kerol.*"—Fresh small wounds were observed to heal rapidly after one application of undiluted "Kerol." Larger wounds, with profuse blood and serous exudations were not so quickly healed.

(5) *Healing Oil.*—An oil which is recommended by the makers for the treatment of screw-worm wounds and is composed of about 45 per cent. turpentine with the addition of various resins, vegetable oils and a small percentage of phenol was tested by the writer, but no marked disinfectant or healing action was observed.

No effective disinfectants have been found for use against the bacteria of screw-worm wounds.

DRYING AGENTS.

A 2½ per cent. solution of tannic acid was used successfully to dry large open wounds. It has the additional desirable property in that it arrests hæmorrhage, and forms a crust on which the repellent substances can be painted.

NOTE ON VACCINE THERAPY.

During recent years a "vaccine" for the control of screw-worm infestation in cattle has been prepared by the Director of Veterinary Research. Some ranchers have reported favourably on its efficacy, and at the Director's request two brews, *viz.*, "Spring Grange" and "Duntyte," were tested on persistent cases at Balla-Balla during May, 1933.

The cases chosen were mostly "weaner" heifers with large wounds which had been repeatedly infested with eggs and small larvæ. Most of the wounds of the cases treated were observed to heal more quickly than those of a control bunch. Further experiments with these vaccines will be made

at a later date. The heifers treated at Balla-Balla were in poor condition, probably due, as already stated, to chronic verminosis and to the mineral deficiencies of the pasture.

NATIVE "REMEDIES."

Tests were made with the leaves of three species of wild shrubs including *Flacourtia ramontchi* L'Hér (Native name "Mabota") used by the Matabele as a dressing for screw-worm wounds. The leaves are macerated by rubbing them between two flat stones and then steeped in water for two or three hours. The infusion is used to wash out the wounds, into which the leaf-tissue is afterwards packed tightly.

No resulting benefit was observed in the cases treated by these native "remedies."

TRAPS.

No Screw-worm Flies were caught in ordinary Blow-fly traps baited with carrion, or in two types of tsetse fly traps. The Screw-worm Fly breeds only in the living tissue of domestic animals, and is not attracted to carcases like common blow-flies.

SUMMARY OF RECOMMENDATIONS.

(1) Regular 5 or 7 days' dipping combined with hand-dressing of hindquarters, etc., with tar is necessary to control Bont-legged Ticks early in the wet season.

(2) Crush pens and dipping pens should be kept in repair to reduce the number of accidents to horns, flanks and legs of cattle. Animals should be held by mechanical means during treatment, not thrown.

(3) Dehorning of all young stock should be carried out at as early an age as practicable.

(4) Ear-marking, castrating, dehorning, and operations to horns should be carried out during occasional spells of dry weather.

(5) Yearling heifers in the early wet season should be put to good grazing, given a "salt lick," and, if necessary,

dosed with "wire-worm remedy" to keep them in a healthy condition in order to resist the weakening effects of myiasis.

(6) The locality where cases are treated should be as open and free from trees as possible. Hospital paddocks with open grassy stretches of country might, if necessary, be created for the purpose of grazing cattle under treatment for myiasis. Thickly bushed areas should be avoided.

(7) All egg masses and maggots should be removed from wounds and effectively disposed of by burning or immersion in paraffin and water.

(8) When cleared completely of maggots the wounds should be disinfected. Undiluted "Kerol" has been found to be satisfactory for this purpose.

(9) Stockholm tar should be smeared thickly with a brush in and around the wounds every three days to repel the fly. The cases should be inspected daily, and any egg-masses or newly hatched larvæ carefully removed and fresh tar applied.

(10) Suppurating wounds which are slow to heal should be cleaned with "Kerol," carbolic oil, or some such substance.

(11) Boracic acid or zinc oxide mixed with a small quantity of iodoform should be dusted on large open wounds which are repeatedly re-infested, in order to hasten the healing process.

(12) Slaked lime should be used to dry large open wounds which tend to become septic. If not healed quickly such wounds soon become re-infested with eggs.

(13) In experiments in trapping negative results were obtained with both Blow-fly traps and Tsetse Fly traps.

Aknowledgements.—The Department is indebted to D. V. Burnett, Esq., General Manager of the London and Rhodesian Mining and Land Company, Ltd., for affording facilities for the above investigations to be conducted at the Glass Block Ranch, Balla-Balla.

Citrus Fruit Growing in Rhodesia.

By G. W. MARSHALL, Horticulturist.

(*Continued.*)

Digging the Holes.—After the area is completely pegged, and if it is intended to dig the holes at once, the whole site must be double pegged to permit of digging the holes where the tree pegs stood. This pegging is simple, and if a suitable marking board is made, the area may be accurately pegged without difficulty. This second pegging may be commenced from any corner of the site and can be continued row by row until completed.

Place the central notch of the marking board close against the tree peg, then set the two marker pegs in the end notches of the board, which may then be moved to the next peg, where the process is repeated, until the site is completely double pegged. The tree pegs may be left standing, as it assists the hole digger to locate the exact spot the tree is to occupy.

All tree holes should be dug if possible several weeks before the planting of the trees is begun, and when this is possible the holes should be refilled with good soil soon after digging is completed to permit of the earth settling down and thus eliminating the danger of the trees sinking too deeply, as is often the case where trees are planted immediately after the digging of the hole. The size of the holes for the trees should be at least 2 ft. square and 2 ft. deep.

The digger must first mark the size of the hole round the tree peg before withdrawing it. He should then dig out 8 ins. of surface soil and place it on a side unoccupied by a marker peg. The second 8 ins. of soil is then placed on the opposite side of the hole and the bottom 8 ins. of soil is

loosened and left in the hole. This procedure is best for soil of good depth and quality.

If the sub-soil be inferior to that of the surface soil the first 8 ins. of soil should be placed as previously suggested and the remaining 16 ins. be dug out from the hole and discarded, the hole being then two-thirds refilled with good surface soil collected from near by and the 8 ins. of surface soil previously taken out being used to complete the filling.

Propagation.—Every orchardist should know how to propagate fruit trees; the knowledge will enable him to re-work unprofitable trees that he may have a variety suited to his immediate locality.

The methods employed in order to raise fruit and other trees may be classed as follows:—From seeds, from cuttings, from layers, grafts or buds. Of these methods of propagation, budding is the most important and will be dealt with more fully than the other methods referred to.

The raising of plants from seed will be described briefly when indicating the methods employed in raising lemon stocks on which the other desired varieties of citrus fruit are later to be budded. Since the rough or Mazoe lemon is at the present time the stock most soited for Rhodesian conditions, there is no necessity to discuss other kinds of stock.

The term stock is commonly used to denote the root portion of a tree, while the word scion indicates the piece of wood, shoot or bud that will form the top or head of the tree.

Propagation by means of wood or root cuttings is of little or no value for citrus fruits, and since it is not recommended, there is no necessity to deal further with it here.

Layering is to be commended when it is desired to raise special trees for certain classes of soils or when any particular variety is difficult to raise by the other methods of propagation.

The process of layering is simple and a brief description will suffice. Fig. 8 illustrates layering, and it will be seen

that by cutting a lateral branch on the selected tree as shown at point (a), together with a second but diagonal cut made about two-thirds through the branch at point (b), the cut branch can be bent into position and pegged firmly to the ground under the tree. A mound of well prepared soil is then placed over the pegged cut end, and if the soil is kept moist, roots will form at point (b). When these roots are sufficiently well developed to support the new tree it may be detached from the parent plant and planted in its permanent position. Layered trees produce fruit identical to that borne by the parent plant.

There is only one style of grafting that can be recommended for citrus, namely, "inarching." When the bark of the main stem has become damaged or diseased near the ground, or should the stock itself be unsuitable, the trees may be saved or the stock changed by this inarching method. Two or more lemon seedlings about the size of that marked 1, which at 18 ins. above ground is about the thickness of a lead pencil, should be planted about 9 ins. from the stem of the tree to be inarched. Four stocks may be planted at the base of a large tree if the damage is considerable. These lemon stocks must be carefully planted and cared for, and then when they become established they should be cut back and grafted to the main stem of the tree, as shown in Fig. 9.

The bark of the tree stem is slit, as will be described later under budding. Cut the top of the lemon stock diagonally and allow a good taper; then insert the tapered end under the bark of the main stem of the tree. The cut surface of the stock must rest evenly on the cambium layer or outer surface of the woody portion of the stem, being nailed there to hold it in position; the loosened ends of the bark will assist to hold the stock in place. The treated area of the stock and tree stem is then covered with grafting wax to exclude all air, and within a comparatively short period a union will be effected between the lemon seedling and the tree trunk, and the necessary nourishment will be conveyed to the tree by the inarched lemon stocks.

Budding.—Shield or inverted T budding only will now be described, as it is the simplest and most universally adopted method of citrus propagation.

The procedure to follow when raising trees by this method of propagation is as follows:—Secure a sufficient supply of rough or Mazoe lemons, and about July plant the seed of the freshly collected fruit in a well prepared seed bed such as that used for raising tobacco seedlings. Place the seeds in rows 6 ins. apart with 1 in. between the seeds, the pips being covered with sandy soil to the depth of about half an inch. Then water whenever necessary with a fine-rosed watering can until the seedlings are large enough to plant out in the nursery; care must be exercised that the seeds do not dry out before or after planting, for if they do they will speedily lose their germinative properties. The best germination is obtained when the seed beds are bordered with brick and covered with tobacco seed bed covering. If the seed is planted in a warm and sheltered spot during July, germination should be completed in a month. Lemon seed is polyembryonic, and many more plants may be raised than the actual number of seeds planted. If the seed is planted in rows as suggested, cultivation will be easy, weeds can be kept down and the seedlings will not crowd each other unduly. Lemon seedlings damp off badly, but this may be overcome by keeping the covering over the seedlings during the heat of the day until the rains commence. The seedlings should then have grown out of the damping off stage.

When the surface soil of the seed bed shows signs of drying after watering, it must be loosened to check weed growth and restrict the evaporation of soil moisture. Cultivation also, by encouraging ingress of air to the soil, restricts damping off.

When the lemon seedlings are from 6 ins. to 9 ins. in height (about November) they may be lifted and planted in the nursery, which should have previously been well prepared. As the seedlings are lifted from the seed beds the healthy and well grown ones must be sorted out; the rest, including those with bench (twisted) roots, being discarded. Shorten back the roots of those selected for planting to about 4 ins.

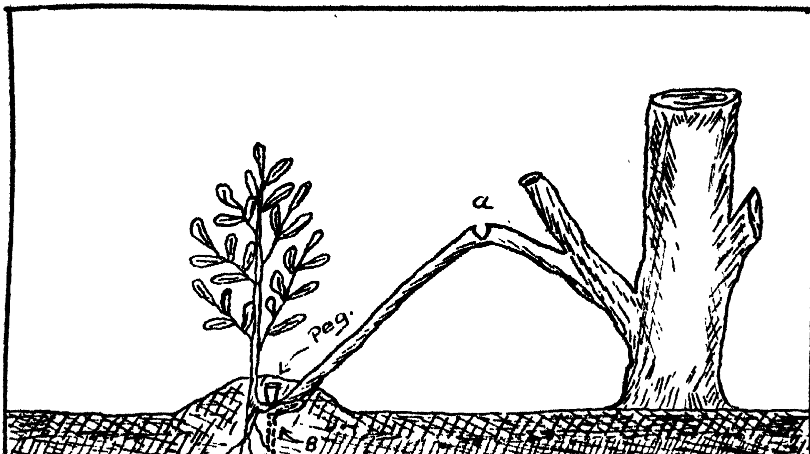


Fig. 8. Layered Branch.

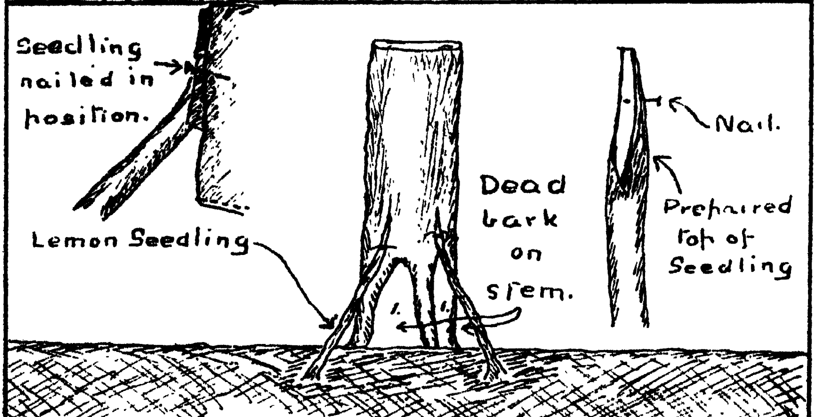


Fig. 9. Inarching.

Fig. 10. Lopped Nursery Tree.

and cut back the tops by one-half their growth. Then plant into rows in the nursery, spacing the plants 12 ins. apart in the rows and 3 ft. between the rows. Choose a dull day for this operation and protect the roots of the seedlings from wind and sun while transplanting. A simple manner of setting the plants in the nursery rows is by means of an ordinary spade, which, after being placed against the marking wire, is then pressed about 6 ins. straight down into the soil, after which the spade handle is pulled forward to make an open slit. The spade is then removed and the seedling is set at the same depth as it stood in the seed bed. It should be held by the top while one foot of the planter should be placed on the side of the slit furthest from the wire in order to press back the soil to close the slit around the roots of the seedlings. Finally, use the boot heel just against the small seedling and firm the soil thoroughly. A small amount of water may be given to each plant as it is set; the water will close any remaining air spaces near the roots. Such air spaces are objectionable, often causing the death of the newly set seedling. If no rain falls within a week of planting the seedlings, they should be thoroughly watered. After each rain or watering the soil should be well loosened round the small plants; this not only checks weed growth and evaporation, but also encourages a rapid growth of the young seedling.

Soon after planting, a vigorous growth of side shoots will be thrown out along the stem from the ground level to the top of the plant. These shoots, with the exception of the topmost one, must be rubbed off while still small and tender; the shoots must be suppressed as they appear, since if left to grow out the stock will become bushy and unfit for budding in autumn. If the shoots will not rub off readily, procure a sharp knife and cut them off carefully close against the stem of the plant; badly trimmed and scarred stocks are difficult to bud, so any injury when trimming them should be carefully avoided. The stocks need only be cleaned to 12 ins. above the ground.

If lemon stocks are kept in active growth by careful tending, they should be fit for budding the following March or about five months after planting in the nursery. This

rapid growth is quite possible in the well sheltered and warm valleys of the Colony.

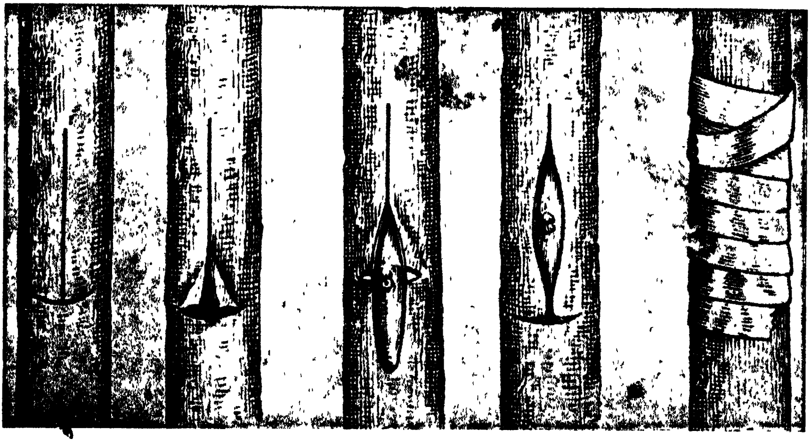
Selection of Bud-wood. —Bud-wood or bud-stick are the terms used to define the small wood cuttings taken from trees from which it is intended to propagate. Having decided on the varieties of citrus fruits to be raised, the propagator should select or obtain bud-wood from trees known to produce heavy and regular annual crops of good, marketable fruit typical of its kind and possessing a thin, firm peel and with few or no seeds, according to the variety.

Other points to look for in the parent tree are yield of a high percentage of the popular selling sized fruits, good texture, flavour and external as well as internal colour. If the best bud-wood is to be collected, a careful record must have been kept of all the best bearing trees in the grove.

The most valued bud-wood on an orange tree is the small stem to which the fruit is attached. Often this is only one or two inches in length and very little thicker than an ordinary safety match; but if the terminal fruit is typical of the variety and the tree is known to produce good crops of quality fruit, the twig should be cut and defoliated, leaving only small leaf stubs of about a quarter of an inch in length. As collected, such bud-sticks should be placed in a cool and damp cloth-lined covered box. If sufficient bud-wood of this particular type is unprocurable from the selected parent trees, good, healthy, round wood up to the thickness of a lead pencil may be taken: after cutting, treat it as recommended for the fruit-stem wood.

When the lemon stocks in the nursery have grown by the following autumn to the thickness of a lead pencil or a little larger, at about 9 ins. above the ground, and provided the bark slips readily (is not firmly attached to the wood), budding should at once be proceeded with. If the bark of the lemon stocks has a tendency to adhere to the wood, the nursery should be irrigated about seven days before budding is commenced; irrigation will stimulate the flow of sap and the stock bark will then slip more freely.

A fine day should be chosen for budding if the best results are to be secured. Hot, windy and wet days should be



(a) (b) (c) (d) (e)

Fig 11.—(a), incision on stock; (b), incision with lower ends of bark raised for inserting the bud; (c), bud partially inserted; (d), bud inserted ready to wrap; (e), bud wrapped with waxed cloth.
(From Year Book, U S Dept. Agr , 1896).

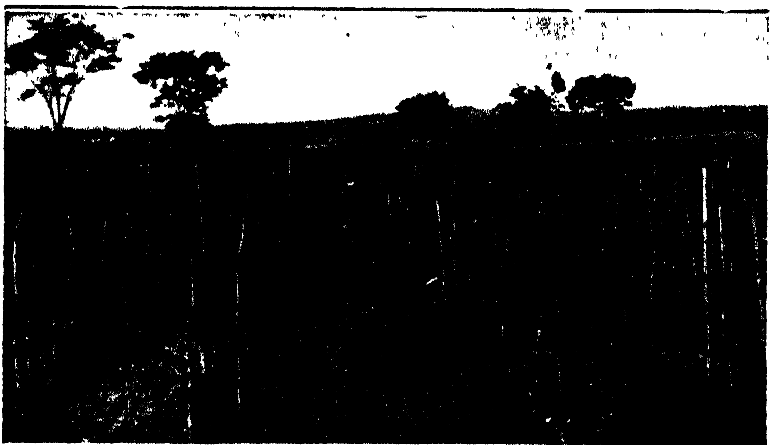


Fig. 12. Young orange trees about 1 to 2 feet in height, staked and tied.

Fig. 13.—Unprofitable Washington Navel tree top worked to grape fruit. One year's growth.

avoided. As soon as the necessary materials—comprising a good, sharp budding knife, raffia for binding and a supply of bud-sticks wrapped in damp sacking—are in readiness, budding may be proceeded with.

The buds should be inserted in the stock from 6 ins. to 9 ins. above the ground level and on the side of the stock which faces east. Select a spot with a smooth and healthy bark at the correct height on the eastern side, make a vertical cut about one to one and a quarter inches in length and then a horizontal cut across the bottom of the first cut. If the back of the blade of the knife is held lower than the cutting edge when the second cut is made, the lips at the intersection of the two cuts will lift sufficiently to permit of the bud being inserted easily. Next take a bud-stick in one hand and the knife in the other, and cut through the bark half an inch above the bud, cutting towards the operator, but only sufficiently deep to cut away a very thin layer of wood along with the bark. If the cut is commenced at the base of the knife blade and the knife is then drawn forward diagonally to half an inch below the bud, the point of the blade should be resting just under the bark; the thumb should now press the almost detached bud against the point of the knife blade. Lift the bud and detach it from the bud-stick, and continue to hold the bud on the knife blade. Insert the free or upper point between the lips at the intersection of the two cuts previously made in the stock, slide the bud up as far as is possible with the thumb-knife grip, take hold of the small leaf stem (retained when defoliating the bud-wood) and slide the bud up until it is completely covered by the bark of the stock, as is shown by diagram (d), Fig. 11.

When the bud is correctly set, take a strand of slightly damp raffia and bind the bud tightly, only leaving the leaf stub exposed; too much raffia is objectionable. About six complete turns is ample, and the tighter it is tied the better.

The stock should be examined ten to fourteen days after budding. If the leaf stub has fallen or detaches easily, the bud has united with the stock; firmly attached leaf stubs indicate the failure of the bud, and the stock should be re-budded.

At each examination of the stocks after budding all shoots arising on the stock between the ground level and 3 ins. above the bud should be suppressed. Any raffia cutting into the stock should also be removed and re-tied where necessary. When the buds are well united all of the remaining raffia should be taken off the stocks.

Waxed bands of about $\frac{3}{8}$ in. in width may be used in place of the raffia if the budding season is at all wet. The buds that unite with the stock will normally remain dormant over winter, and when the stocks show signs of commencing growth in early spring (August) the stocks should be partially cut about 3 ins. above the dormant buds and bent over as illustrated in Fig. 10.

The dormant buds will now start into active growth, and when the bud shoots have grown to about 9 ins. in length they should be tied to the stock stub; this tying reduces the risk of breakage at the union, which at this stage is insecurely united with the stock. When the bud shoot has grown to 12 ins. or 18 ins. in height the partially detached top of the stock may be completely removed, since the young bud will now be capable of utilising all of the plant food supplied by the root system.

To secure a good straight-stemmed tree the growing bud shoot (scion) must be tied with raffia to a straight, wooden stake about every 6 ins. apart. See Fig. 12. When the trees are about 3 ft. high, cut off the stock stub diagonally just above the union of the stock and scion. See Fig. 10 (a). The wound will then callus rapidly. The trees may be allowed to grow to a height of from 4 to 5 ft. and should then be headed back to 3 ft. above the ground. Many shoots will develop after this heading back; rub off those that appear between ground level and a height of 2 ft. up the stem, retaining five or six well spaced shoots on the upper 12 ins. of the stem. On no account should two shoots be permitted to develop from the same spot; double shoots are objectionable and they may result in the breaking of large limbs after the trees are in bearing.

When the retained shoots on the upper 12 ins. of the tree stem are well grown and the tree is again dormant, it

will be ready to lift and transplant to its permanent position in the grove.

Top Working Unprofitable Citrus Trees.—The grafting or budding of large citrus trees is often unsatisfactory, and as it is easier to replace them with good young trees, large unprofitable trees should generally be rooted out. If the unprofitable trees are small to medium in size, they may be headed back very heavily and then be allowed to form a new head. This new growth must be thinned down to two or three shoots on each limb, and when these are sufficiently large they can be budded to the desired variety in the same manner as that already described for the budding of nursery stock. These buds should remain dormant over winter and then commence growth about August, after the shoots have been shortened a little. When the buds are well grown the stubs may be cut as previously recommended and the new head of the tree should, with good treatment, then grow quickly and possibly produce fruit the second season after top working. Fig. 13 illustrates an unprofitable Washington Navel orange tree top-worked to grape fruit one year after budding.

Ordering of Trees.—When a purchase of citrus trees for planting is to be made they should be ordered well in advance of the planting season. It is best to buy the trees from reputable nurserymen who raise good and healthy trees from selected parents. First-sized trees only should be used; smaller trees are often runts and seldom give good results. Fig. 14 (3) shows a good first-sized tree twelve months after budding. In Rhodesia first-sized trees may be produced in 12 months from time of budding, and at longest within two years.

Time of Planting.—Citrus trees may be planted at any season of the year, provided irrigation facilities are available and the trees are not in active growth. When only a few are to be put out, and assuming they are procurable, August is as good a month as any in which to plant. Given good attention and a full growing season, August planted trees will out-grow those planted later in the year. For extensive plantings, however, the rainy season should be chosen, for

then there is less danger of mortality amongst the plantings. January and February are good times to plant if the trees are dormant. Trees planted in January will do better than those planted later, as they are more capable of withstanding any unfavourable climatic conditions which may occur during the succeeding winter.

Method of Planting.—On arrival of the trees from the nursery they should be placed in a shady spot and kept moist until planted. They should not be left any length of time in the boxes or tins in which they were packed, but should be heeled into a trench and kept there until wanted. The heeling-in process consists in digging a trench about 18 ins. in depth with one side sloping at an angle of about 45°. The trees are laid in not more than two deep, the soil being well worked in around the roots and the trench then being filled with soil and watered occasionally to keep the trees in good order.

Before planting is commenced it is well to be sure that all the necessary appliances are at hand. These are:—Marking board (previously used when double pegging), spades, sacking to protect the tree roots, secateurs to trim the tree roots and tops, Bordeaux paste and brush to colour-wash the tree stems and a sufficient supply of water to water the trees when planted.

Everything being in readiness, a few trees are then taken from the heeling-in trench, the roots being wrapped in damp sacking. Proceeding to the first hole, have a small hole dug between the two pegs, then place the marker board side notches against the two pegs. Take a tree from the damp sacking and cut out the broken, twisted, damaged or diseased roots, shortening back those that are too long. All cuts should be made diagonally on the under side of the roots. Care should be exercised that the roots are not at any time during planting unduly exposed to sun or wind. Cool and overcast days are best for planting, but these favouarble conditions are not always to be had. The stem of the tree is now placed in the central notch, with the upper roots almost touching the planting board; the soil is then filled in slowly, the roots being evenly spread in all directions and well covered. Now remove the marker board and shake the tree

slightly with an up and down action; this will assist the fined soil particles to collect round the roots and fill any air spaces. A slight mound should next be made over the roots at the base of the tree, after which the soil should be firmed by tramping it well over the roots and up to the stem. Citrus trees must not be set too deeply; plant them no deeper than they stood in the nursery. This depth will be indicated by the nursery mark (junction of the yellow and green bark near the roots).

It is an advantage to keep the nursery mark 2 ins. to 3 ins. above the soil level; the tree will then be well planted, and as the soil subsides the tree will gradually sink to the nursery mark level. If the upper roots of the newly set tree are very close to the soil surface a small mound of loose soil may be placed over them; this will prevent any overheating or undue drying of the soil surrounding the shallow roots. This mound will gradually disappear with cultivation, but not before the tree is well rooted and no longer requires this additional protection. After planting, cut the top of the tree back. Up to six well-spaced arms may be retained; the heading back of the tree will enable the reduced root system to feed the proportionately reduced top in a normal manner.

Many fruit trees are planted without cutting back the tops; this is wrong, and causes an undue demand on the root system, of which over half was left in the nursery at the time of lifting. The larger the tree, the greater the loss of roots at lifting. To counteract the loss of roots a proportional amount of the top must be cut away at planting.

The trees should be watered as they are planted with at least eight gallons of water to each tree, and more if the soil is very dry. The watering will settle the soil and at the same time supply the tree with the necessary moisture with which to revive growth.

The stems should be colour-washed with Bordeaux paste to prevent sun scald. When the surface of the soil is sufficiently dry after watering it may be lightly loosened again to check evaporation.

Citrus Varieties.—Many varieties of citrus fruits are grown in Rhodesia, but only those of commercial value need be

referred to. The orange is the most important, and a brief description of the leading varieties will be given in their order of popularity.

Valecnia Late.—Plate 15, Fig. 6.—Fruit almost seedless, oblong, medium size, rather acid, trees grow well and bear good crops of fruit. Ripens late August-October. The best export orange.

Washington Navel—Plate 15, Fig. 4.—Seedless, sweet, medium to large, erratic bearer, many undesirable strains, does best at the lower elevations and near the sea. Ripens early, May-June. The best and most popular orange where it does well.

Variations in Washington Navel oranges—Fig. 15a.—

1. Illustrates a large, coarse Washington Navel orange, which is often dry.
2. A very inferior type of Navel of poor shape. The trees grow very large and are shy bearers.
3. This is a Thompson's Improved Navel; the fruit is often dry and woody in Rhodesia.
4. Illustrates á good type of Washington Navel orange; very juicy and of good texture.

Mediterranean Sweet—Plate 15, Fig. 1.—Few seeds, size medium, good bearer, ships well, mid-season, ripening between Washington Navel and Valencia Late, possibly the best mid-season friut.

Du Roi—Plate 15, Fig. 12.—Similar to the Valencia, but fruit more spherical, medium size, contains more seeds than Valencia, very heavy cropper, late ripening.

Jaffa—Plate 15, Fig. 13.—Form rounded oblate, has about 9 seeds, size medium to large, mid-season ripening, often thick-skinned here. This variety is often confused with "Joppa."

Joppa—Plate 15, Fig. 10.—Medium to large, mid-season, oblong, seeds few, does not uphold its reputation in Rhodesia.

Paper Rind St. Michael—Plate 15, Fig. 14.—Fruit small in Rhodesia and is not recommended.

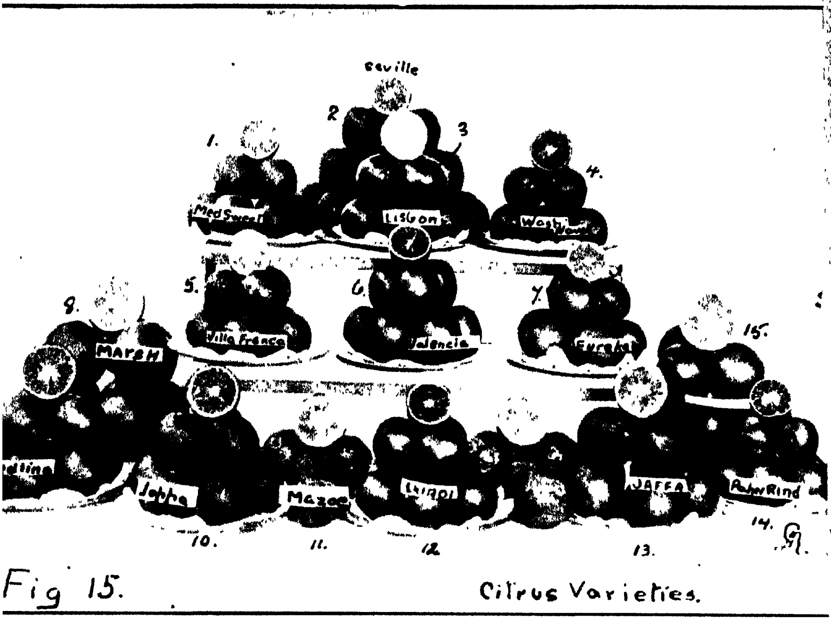


Fig 15 --Rhodesian grown citrus varieties.

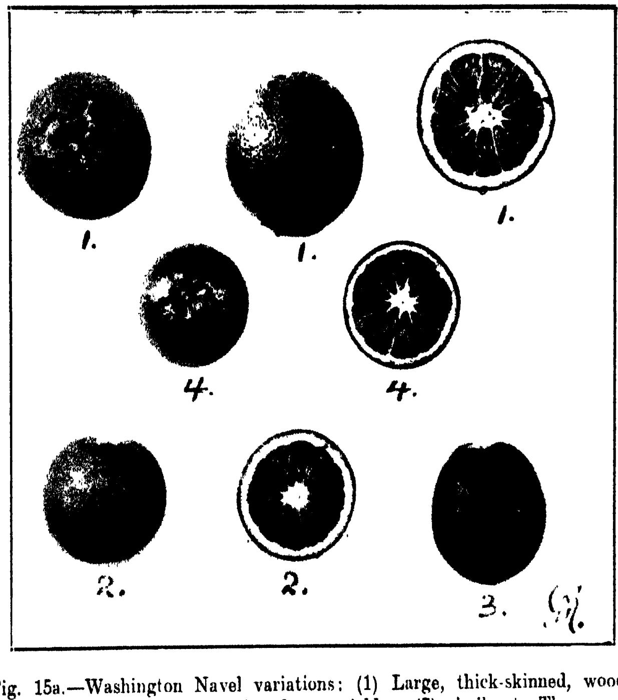


Fig. 15a.—Washington Navel variations: (1) Large, thick-skinned, woody fruit; (2) round, thick-skinned and poor yielder; (3) similar to Thompson's Improved Navel, and always woody in Rhodesia; (4) suitable for export.

Seedling Orange—Plate 15, Fig. 9.—Up to the present not exported from Rhodesia.

Of the seedling orange varieties grown in Rhodesia, most if not all are particularly good types, which have been chosen and propagated because of certain superior qualities which they possess. A means of ascertaining the best seedlings would be to offer liberal cash prizes at the agricultural shows for the best plate of fruit from a single seedling tree, each entry to be accompanied by data showing the exact location of the tree from which the fruit is taken, so that it may be examined by experts and propagated. In this way, if a few of the best seedlings could be located and propagated, they might actually prove to be superior to any of the usual varieties now grown.

Bitter Seville—Plate 15, Fig. 2.—Grows well in Rhodesia; used for marmalades, etc.

Grape Fruit (Pomelo): Triumph—Plate 15, Fig. 15.—Slightly smaller than the "Marsh," many seeds, perfect flavour, best variety for Rhodesia, excellent export quality, is produced in a few areas.

Marsh Seedless—Plate 15, Fig. 8.—Few or no seeds, fruit large, flavour good, thick-skinned in many areas, export quality produced at low elevations.

Lemons: Eureka—Plate 15, Fig. 7.—Trees almost thornless, medium size, juice abundant, flavour good, thin rind, good bearer. Our best lemon.

Villa Franca—Plate 15, Fig. 5.—Fruit oblong, juicy, almost seedless, sweet rind, heavy bearer. A good second to "Eureka."

Lisbon and Genoa—Plate 15, Fig. 3.—Medium size, oval, smooth skin, good quality; only a few grown.

Limes: Tahiti.—Almost as large as a lemon, juicy, thin rind, seedless.

Naartje: Old Cape.—Popular in Rhodesia, trees vigorous, heavy bearer, stands drought well and resists most pests and diseases.

Emperor.—A good second to "Old Cape."

Irrigation.—No excuse need be offered for again emphasising that no citrus grove should be laid down in Rhodesia unless there are adequate facilities for irrigation; especially is there need for this warning in view of the fact that some planters are still under the impression that irrigation of the groves is not essential. The rainfall of Rhodesia cannot be relied on for an even distribution, hence the necessity for artificially applying water during the long dry spells that occur from March to October. When the rains are late in setting in it is often necessary to continue irrigation up to November or even later, while on the other hand in some years the rains continue into April, in which case, provided the land is thoroughly worked up, it is not necessary to irrigate the early ripening fruit prior to picking.

It may safely be said that no definite period is the right one in Rhodesia for irrigating citrus trees. One year it may be necessary to commence irrigation in April on account of the early cessation of rains, and continue right through to December; whereas in another year no irrigation might be necessary until July, and if good, early rains come in October, no further application of water might be required after this date.

It is often stated that the actual amount of water required to be added by irrigation can be gauged by the average rainfall of that section of the country, but growers would be well advised not to put too much faith in this assertion on account of the uncertainty of the distribution and incidence of rains. A large percentage of the rainfall in Rhodesia is of little value to citrus trees, in that it frequently happens that several inches fall within a very short space of time and consequently most of this runs off into adjacent spruits and rivers, since the soil is unable to absorb it.

Having shown that the application of artificial water is a necessity, it might be advisable to give some idea of where to apply it and some of the methods by which it is done. Briefly, a citrus tree should never be allowed to show any signs of distress from want of moisture, such as curling up of leaves or wilting. Now this may occur at any time of the year, even during summer in abnormally dry seasons, and it is not therefore possible to state any exact period when

water should be applied, since the character of the soil, temperature and many other factors vary so extensively. For the same reasons broad statements of the amount of water required can merely be suggestive and should not be followed as hard and fast rules.

The trees require water at the time of blossoming and after in order to enable them to set and hold a full crop of fruit; further, as a citrus fruit takes about nine months to mature, it is necessary to be able to apply water at intervals during the whole of this period up to within two or three weeks of the picking of the fruit. From June to November in daytime the sunshine is practically continuous and getting hotter each day; in consequence, throughout a most important period in the annual life of the tree the evaporation is at its greatest, and thus there is the greatest need for the provision of water during these months.

Roughly speaking, the irrigation of citrus trees should commence before blooming and be repeated every month to six weeks until the rains arrive; also during summer if the rainfall is insufficient to keep the trees in good growth. Whatever the system of irrigation used, the water should soak deeply into the ground. See furrow system, Fig. 16.

The benefits resulting from irrigation may be said to be due to the ability to apply water at the right time and in sufficient quantities so that the regularity of the crop is ensured. There is in many soils in Rhodesia perhaps sufficient moisture conserved from the previous wet season to enable the trees to bloom profusely, but not to give them enough vitality to set the fruit and carry it on to full and satisfactory maturity. This is a point that some growers seem to lose sight of, but this particular point makes all the difference between a prosperous orchard and a failure.

The amount of water required to irrigate an acre of full-grown citrus trees can be roughly estimated as a quantity equalling 75,000 gallons per acre per application, or approximately a three-inch watering. This may be taken as the maximum amount required for trees seven years old and over, while the water required for younger trees will be proportionately less. Thus a very small amount is necessary the

Irrigation Systems.

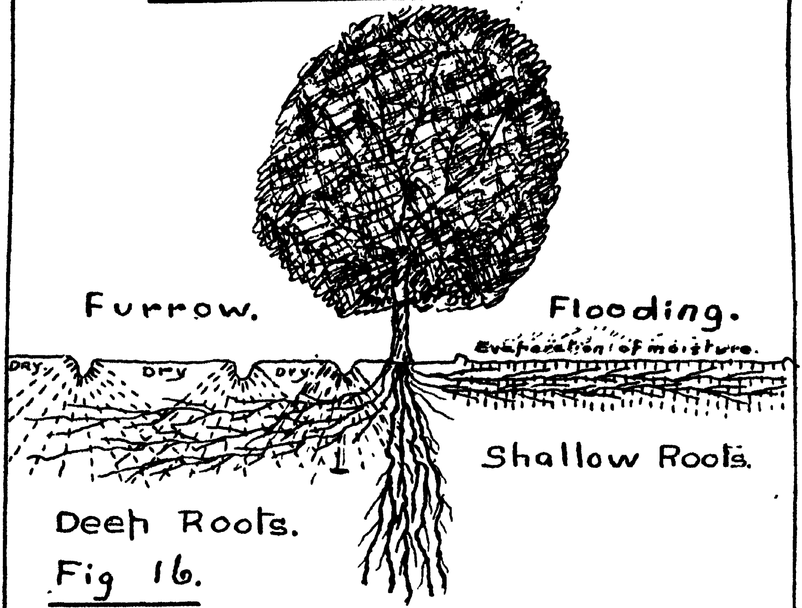


Fig 16.

Manurial Methods.

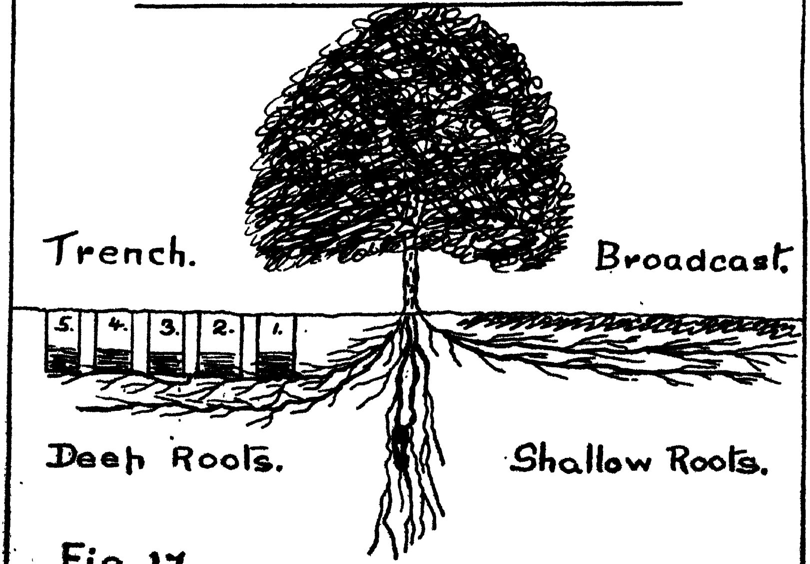


Fig 17.

first two years, but at more frequent intervals, while during the next two years the trees will have grown very considerably and may even be bearing some fruit, when it might be advisable to allow up to one-third or half the maximum amount for grown trees.

This water duty is given on the basis of delivering the water in pipes, flumes or earth ditches to the immediate vicinity of the trees to be irrigated, but, as remarked above, such figures can only be accepted as approximate. It may be said on this point that in some localities, under certain favourable conditions, one-half the quantities quoted above would be nearer the mark.

The method of applying water is governed to a great extent by the amount available. In groves that have been carefully graded the best way is by running water in furrows, four or six of these, say, being ploughed deeply with a double mouldboard plough between each row of trees and none closer than four or five feet from the tree stem; this distance from the trees applies to the large bearing trees, and it can be reduced for young trees to, say, three feet. Before the trees reach bearing age it is best to supply water in a modified manner, namely, by drawing a furrow from three to four feet, according to age, on every side of each row of trees. (See Fig. 18.) This system can be enlarged as the trees get older by drawing two or more furrows on each side of every row.

The three system of irrigation adopted in Rhodesia are:—

No. 1. By furrows.
No. 2. By basins.
No. 3. By flooding.

No. 1 method—by furrows. To lay out the orchard for this method of irrigation, plough four or six deep furrows between each row of trees, but none closer than three to five feet to the tree stems, taking the furrows along the best gradient to avoid soil erosion. This ploughing may be done with an ordinary double mouldboard ridging plough or with a two or three-furrow ridging cultivator. The work is done more quickly by the latter method, but the cultivator has the disadvantage of not going so deep as the plough. As the

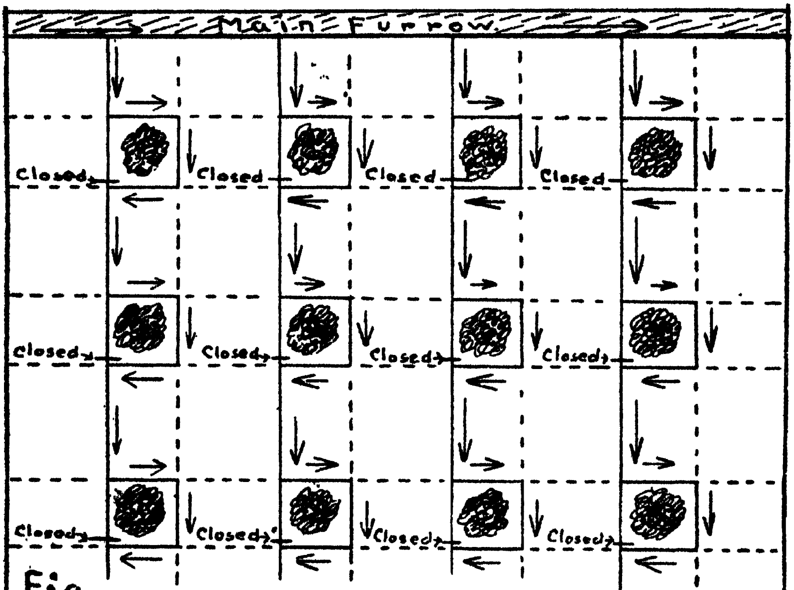
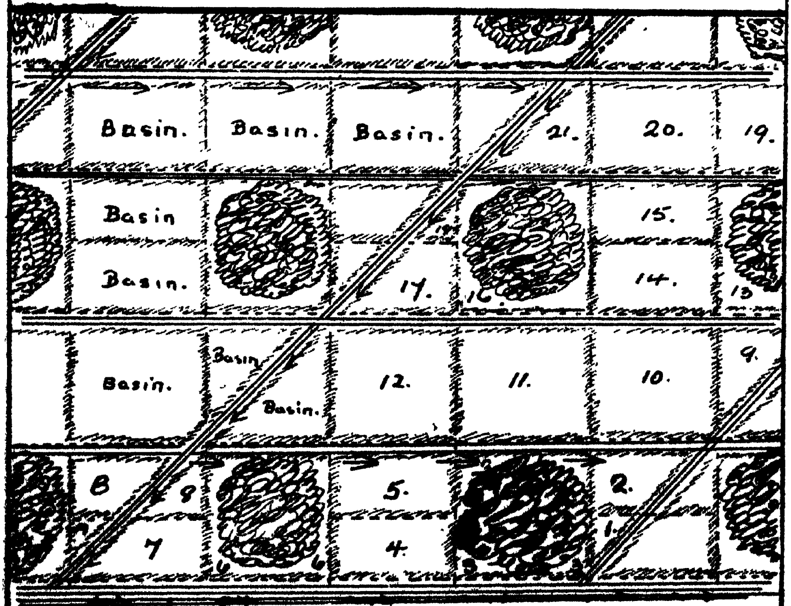


Fig. 18. Furrow Irrigation for small Trees.



Basin Irrigation.

Fig. 19. Furrows. Ridges.

trees grow, most of the space is occupied and there is then a difficulty in running the furrows close enough to the trees, so that a large space between the rows of trees does not get wetted. The way to obviate this trouble is to cross-furrow along the diagonals most suitable for the purpose. When the area to be irrigated has been laid out in furrows the water is applied fairly quickly until it is nearing the furrow end, when it is reduced to a small stream and kept running constantly over the entire length of each individual furrow without causing any undue washing and a minimum wastage of water.

The time required to moisten the land sufficiently depends on the nature of the soil and the climatic conditions, and may vary from 12 to 24 hours. With a view to facilitating both irrigation and cultivation it is advisable to plant citrus trees in blocks of not more than 10 acres each. The length of the irrigation runs may vary from 200 to 300 feet, but where the soil is porous and on a moderate slope, 200 feet runs are about right, while in very scanty or gravelly soil the run may still further be reduced.

To ascertain to what depth the water has penerated the soil a soil auger should be used fairly frequently, and when the moisture has penetrated to a depth of four feet irrigation may be suspended.

Fig. 18 shows the modified furrow irrigation for small trees. The arrows indicate the direction the water in flowing. The points marked "closed" prevent a direct flow of water; it then dams on this side of the tree and the water follows the course indicated. The dotted lines are the unused furrows between the trees.

In Fig. 16 it will be noticed that the moisture penetrates to a greater depth when applied by the furrow method, provided the water is permitted to flow sufficiently long, hence the necessity to test the moisture penetration. As many furrows as are possible should be supplied with water at the same time.

No. 2 method—basin irrigation. Fig. 19.—This method of applying water is suited for very sandy and porous soils,

also for sloping ground that is too steep for the furrow method.

Two deep furrows should be drawn with a double mouldboard plough between each row of trees, then diagonal furrows where necessary, as indicated in Fig. 19. All of the furrows will have suitable ridges on either side; the cross ridges must then be thrown up by hand or any appliance made for the purpose. A ridge should also be made about two feet distant round the stem of each tree to prevent the water coming in contact with it. This precaution must be taken with every method of irrigation, though not necessarily by ridging as with the basin method. Serious injury may be done to the trees if water is permitted to come in contact with their stems.

When the furrows and ridges are completed, water is then brought down the furrows indicated by the arrows and the basins are filled with water to a depth of three or four inches. The stream of water should be fairly strong to fill the basins quickly, and they should be filled in the order shown by the numerals 1 to 21, Fig. 19. When a section is completed, the stream of water is then taken down the next diagonal furrow to where basins A and B are shown, and the filling process is continued until that section is completed, and so on until the whole area has been watered. In short, commence filling at the lowest basin and end at the uppermost.

No. 3 method—flooding.—The flood method of irrigating citrus trees has been in vogue from time immemorial; it has many disadvantages, the chief of which may be summarised as follows: Water does not penetrate the soil to the required depth, the loss of moisture through evaporation is excessive, a shallow rooting is encouraged and erosion may often be caused.

In Fig. 16 the flooding and furrow methods are compared, and the better of the two methods is clearly shown.

The one and only advantage that may be claimed for the flooding method is the possibility of creating humid conditions in a citrus grove at the blossoming and subsequent fruit-forming stage—August to October.

Some citrus varieties, notably the Washington Navel orange, are prone to drop their setting of young fruit during dry weather, but if the frequent flooding of such groves is resorted to, the atmosphere will become more humid and a better setting of fruit may be anticipated. Irrigation every fourteen days will be ample to create the necessary humidity, and if each time a light harrow is drawn over the land as soon as it is fit to work, the soil moisture will continue to be liberated gradually and will thus render the air more humid.

It may be advisable to mention a few of the mistakes in irrigation which must be avoided. A safe way to encourage collar rot is to make basins about the stems of the trees and fill these with water; this method also cramps the root system instead of inducinig the roots to feed far away from the trees, as they should do. Another method not to be recommended is one that was commonly practised in the Transvaal some years ago, *viz.*, every few days to lead the water down a furrow or furrows on either side of the trees, and when the stream reached the bottom of the furrow to cut it off and leave the furrow open. When water was applied the next time it was led into the same furrow, and the same practice was continued right through the dry months. This method is wasteful of time and water; the greater quantity of water is lost by evaporation, and moreover, if the water supply for any reason is not available, the trees will consequently suffer much sooner than would be the case if water had been more intelligently used.

(To be continued.)

Southern Rhodesia Veterinary Report.

NOVEMBER, 1933.

AFRICAN COAST FEVER.

No cases occurred.

TRYPANOSOMIASIS.

Two cases detected in eastern Melsetter.

ANTHRAX.

Two deaths occurred in Mazoe district adjoining an old infected area. The incontacts are being inoculated.

TUBERCULOSIS.

Tubercular glands were found in a number of pigs slaughtered at one of the abattoirs. Ten cattle tested on importation with negative results.

HORSESICKNESS.

Two cases in Melsetter district.

MALLEIN TEST.

Ten horses were tested on importation, results negative.

IMPORTATIONS.

From the Union of South Africa: Bulls 10, horses 13, sheep 253, pigs 98.

EXPORTATIONS.

Sheep 1.

To the United Kingdom *via* Union ports in cold storage: Fore quarters, 4,526; hind quarters, 4,531; boned quarters, 4,671; livers, 10,495 lbs.; tongues, 8,138 lbs.; hearts, 10,361 lbs.; skirts, 3,105 lbs.; shanks, 10,190 lbs.; tails, 5,006 lbs.; kidneys, 833 lbs.

Meat Products: Beef fat, 50 cases; tongues, 18 cases, 3 tins; meat extract, 110 cases; beef powder, 332 cases.

G. C. HOOPER SHARPE,
Acting Chief Veterinary Surgeon.

Locust Invasion, 1932-34.

Monthly Report No. 13. December, 1933.

Red Locust (*Nomadacris septemfasciata*).—Egg-laying continued through the month, resulting in the presence of egg deposits in all districts in the Colony. In some parts egg deposits are exceedingly extensive.

The first hatchings occurred on about 10th December, indicating that egg-laying took place on about 10th November, that is, at least eleven days before the date stated in my November report. The incubation period varied somewhat, but in most cases recorded, the period has been 30 to 32 days. During last season the incubation period was considerably longer owing to the cool wet weather experienced.

Towards the end of the month hatchings became more general, twenty of the districts reporting hoppers. These hatchings were more or less confined to the lower parts of the Colony. It is expected that the majority of hatchings will occur during the first half of January. In general, the hopper outbreak may be regarded as being five weeks earlier than during last season.

Most of the flying swarms died off during the month, a few only being reported towards the end. Flying swarms caused considerable damage to a number of maize crops.

Enemies.—Owing to the fact that eggs and hoppers attracted the greater public attention, few adults were sent to headquarters during the month. Thus no attempt can be made to appraise the value of the Tachinid reported in November as parasitising adults.

Maggots of the fly *Stomorhina lunata* have been found destroying locust eggs in various, widespread localities, but no phenomenal measure of control appear to have occurred. Yellow Coleopterous grubs have been found feeding on eggs, and an attempt is being made to rear the adult beetle for purposes of identification.

A small outbreak of hoppers was reported to have been controlled completely by black storks (*Abdimia abdimii*) in one district.

Campaign against Hoppers.—A campaign against hoppers was started in some districts in the latter part of the month, but the general campaign will commence in January.

Tropical Migratory Locust (*Locusta migratoria migratorioides*).—Only two specimens of hoppers of this species have been included with specimens of the Red Locust received at headquarters. Both species were in the first stage on receipt.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

DECEMBER, 1933.

Pressure.—The barometric pressure was generally above normal, particularly in the south.

Temperature.—Mean temperatures were generally below normal.

Rainfall.—The rainfall was very patchy. Heavy rains were experienced on the 1st, but it cleared rapidly and was fine from the 4th to the 8th. Rain occurred again from the 9th to the 18th, and a further short period, mostly in the North, at Christmas. The approximate total for the month amounted to 4.30 inches, or about 1.3 inches below normal. The total rainfal October to December amounts to 10.8 inches compared with a normal of 9.9 inches.

Thunderstorm and Squall at Salisbury on the 1st December, 1933.—A considerable proportion of the rain in Southern Rhodesia occurs with thunderstorms accompanied by squalls. A Dines anemometer has been in operation in Salisbury for the last ten years and the wind velocities recorded are generally low. The highest velocities occur in the squalls associated with thunderstorms and rarely exceed 40 m.p.h.

At least three different types of thunderstorm are distinguishable in Southern Rhodesia.

The proper Line Squall appears occasionally associated with the passage of a trough of low pressure from South to North. The wind in front of the squall is usually light and blows from the North or North-west. The squall is from the South and usually settles down to South-east after an hour or so. A marked drop in temperature accompanies the squall and the temperature remains low for a day or two afterwards.

The second type is probably the "Heat Thunderstorm." It occurs in hot weather and travels against the surface wind, which is usually very light. As a general rule these storms travel from South to North at a velocity of 15 to 20 m.p.h. The wind squall is in the direction of travel of the storm and lasts for a short time, the wind then falls calm and works round more or less rapidly to the original direction. A temperature fall accompanies the rain, but a rise is experienced after the passage of the storm.

Comparatively little is known of the third type. It occurs during periods of general rain and may affect a large area. The sqaull shows as a sudden increase in wind velocity without appreciable change of direction and the temperature effects are not very marked.

The first type is undoubtedly due to the invasion of cold air in front of an approaching high, the formation of the squall line is, however, comparatively rare, and in the South of the country particularly, the cold air invasions are associated with the onset of cold rain and drizzle. The second type has been the subject of some investigation and a number of cases have been discovered which indicate that these storms are liable to form when a shallow warm humid surface current of air is overlaid by a deep current of presumably cold air. The warm current has a dewpoint at the surface of 60° F. or more and is usually only about 2,000 ft. thick and the movement is from a Northerly direction, the upper wind is from a Southerly direction and shows a uniform velocity and direction for several thousand feet.

The squall of the 1st December was of the second type. The charts of wind, pressure, rain and temperature and humidity are reproduced. The wind recorder is an M.O. pattern Dines anemometer of considerable age with the vane at 66 feet, it is shielded by buildings and trees and its effective height is probably under 40 feet. It was originally fitted with ½ inch pipes, but these have been replaced with ¾ inch and the direction mechanism modernised. The barograph is an excellent aneroid instrument by Negretti and Zambra recording millibars, the rain chart is from a Casella syphon gauge and the temperature and humidity from a thermohygrograph

in temporary use, the temperature pen is about half an hour fast. The lower figure on the barograph chart should read 850 mbs. not 860 as shown.

A pilot balloon ascent was made at 6.32 a.m. and showed a N.E. wind of 6 m.p.s. from 500 to 3,000 ft. and a steady Easterly from there to 6,000 ft. The surface wind was between N.E. and E. up to noon when it became Easterly and weakened. At 12.35 the squall arrived from the South-east and the velocity rose rapidly to 40 m.p.h. The peak velocity occurred at 12.55 when 63 m.p.h. was recorded and the wind fell to calm, a gentle N.W. commencing at about 2 p.m. A second squall appears on the reproduction at 3.30 p.m., this was associated with the more general rains over a wide area. The rain commenced with the squall and amounted to 1.30 ins., 1.20 of which fell in 17 minutes, a few small hail stones were observed.

The temperature fell 19° F. in half an hour. The barograph rose 1.5 mbs. and thereafter shows a very wavy line. The high wind velocities are shown by the embroidery which is rarely seen in Salisbury.

A questionnaire was sent out to over one hundred residents in the area within a radius of 25 miles of Salisbury and 84 replies received, very full reports were received from the Postmaster-General's department, the Town Electrical Engineer and the Curator of Prince Edward Dam. The latter officer traversed part of the path of the storm within a short time of its occurrence.

The information is by no means complete, but it appears that the storm started at approximately 12.30 along a line immediately South of the Hatfield Estate (about 6 miles S.S.E. of the Salisbury Observatory) with a front of 5 or 6 miles. The first reports indicate that the full fury was developed at once, the telephone and electric power lines running North and South on the Western boundary at Hatfield were damaged for a considerable distance, some of the steel telephone poles were bent over to an angle of 45° and others broken off. The wind appears to have come from an Easterly to South-easterly direction at this point. On the Easterly side of the storm at the Epworth Mission "trees were uprooted,

houses blown over and one native killed; the hail was terrific with stones as big as shillings and blue lightning and unusually heavy thunder." The Tobacco Experiment Station 4 miles N.N.W. reports "two or three small native trees blown down, about 1 inch of rain and a heavy fall of hail lasting ten minutes, the largest stones being the size of pigeon eggs." The squall was also observed at Makabusi farm and some minor structural damage occurred at Hillside.

A certain amount of damage was done to buildings in Salisbury, the tiled roofs of the High Court and the Post Office were affected. Practically the whole of the town was swept by the storm, but it appears that the maximum wind velocities were experienced on the Eastern side.

Slight damage was done at the Agricultural Experiment Station to the North of the town and a mild squall was observed in the Northern suburbs. The last report of appreciable damage was from Pendennis, 5 miles North of the Observatory, where "the wind was terrific, a proper hurricane," and some structural damage was done. The storm appears to have worked itself out in the neighbourhood of the farms Glenara and Eskbank, about 11 miles North of the Observatory. No hail was reported North of the Observatory.

Taking the storm as a whole, it originated on a front 6 miles long and its course was traceable for 17 miles in a N.N.W. direction, the width varying from 4 to 6 miles. The distance was traversed in half an hour, giving a velocity of, say, 30 m.p.h., and destructive velocities were experienced for the first 11 miles; appreciable hail was observed over the first 3 or 4 miles only. There is some slight evidence that the wind diverged more or less to either side of the line of passage in the form of a fan. No measurement of cloud height was attempted, but the visibility from the Observatory was very considerably reduced owing to the intensity of the rain.

DECEMBER, 1933.

Station.	Pressure Millibars, 8.30 a m.		Temperature in Stevenson Screen °F.								Rel. Hum	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max	Min.	Max.	Min.	½ Max. Min	Normal.	Dry Bulb.	Wet Bulb	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	99	58	87 1	65 7	76 4	78.3	76 0	68.4	68	65	...	2.55	4.5	9	...
Beit Bridge	963.0	...	102	58	88 7	66.8	77 7	...	77.2	67.7	61	63	3 8	2 03	2.2	4	1,510
Bindura...	890 5	...	85	56	79 5	62 8	71 1	...	69 5	63.9	73	61	6.2	2 96	6 6	11	3,709
Bulawayo	868 1	867 5	89	51	78.6	59 5	69.1	71.7	68 2	61 2	67	57	5.8	3 01	5.2	11	4,425
Chipinga	891 7	...	85	53	76 9	60 1	68 5	...	69.5	63 5	73	60	5 3	5 96	7.4	16	3,684
Enkeldoorn	857.1	...	85	50	77 1	57 4	67 3	70.7	66 9	60 8	71	57	4 2	4 05	6 5	9	4,787
Fort Victoria	894.6	893.7	91	54	81 2	60.1	70 6	73 0	71.2	63.3	64	59	5 0	2 41	5 6	9	3,570
Gwaai Siding	902 7	...	95	54	85.4	62.2	73 8	...	72 4	63.9	63	59	4 9	4.95	5.0	9	3,280
Gwanda	905.3	. .	94	54	82 5	62 1	72.3	...	71.4	63 5	64	59	4.5	1.51	4.7	7	3,228
Gwelo	862 0	861.3	87	52	78.3	58.3	68 3	71.9	67.8	61.5	70	57	4 4	2.46	6.0	12	4,627
Hartley	885.8	...	87	55	80 4	60.7	70 5	73.8	69.6	63.5	72	60	4 4	4.36	6.9	10	3,878
Inyanga	835.1	...	78	44	72 5	54 9	63.7	...	66.7	58.4	62	52	5 9	4.59	7 0	10	5,513
Marandellas	835 3	...	80	51	74.8	56.5	65 7	...	65 2	59 0	70	55	6.2	4 3C	7.4	12	5,450
Miami	877.9	...	84	57	77.4	61.1	69.3	...	68.4	63.9	78	61	7.6	7 39	5.9	10	4,077
Mount Darwin ...	906.4	...	86	57	80.4	63.3	71 9	..	71.3	65.6	74	63	6.8	5.78	6.2	9	3,178
Mount Nuza	...	...	73	44	63.3	51.3	57.3	...	58 5	54.6	77	53	7 4	12.59	...	17	6,666
Mtoko	876.5	...	86	53	79.4	61.4	70 4	...	70.1	63.4	70	59	4.3	3.76	6 6	10	4,140
New Year's Gift...	...	...	92	58	82.6	61.5	72 1	...	72 7	65.9	69	62	...	2.12	5.9	13	2,690
Nuanetsi	959 9	...	102	55	88.5	65.1	76 8	...	77.2	68.1	63	63	4.4	.32	3.3	8	1,650
Plumtree	863.3	...	90	52	80.4	60 5	70.5	...	70.0	60.7	57	55	4.2	3.69	5.3	10	4,549
Que Que	881 0	...	88	53	80 7	60 3	70 5	...	69.8	63.4	70	60	5.0	8.13	6.2	9	3,998
Riverbank...		...	94	54	83 6	61.3	72.4	74.8	71.3	63.2	64	58	...	3.92	5.8	9	4,090
Rusape...	861.3	...	84	47	77 6	57.2	67.4	...	66.4	60.5	70	57	5.3	4.01	7.4	11	4,630
Salisbury	854.1	853.9	82	51	76.7	58.0	67.4	69.6	68.1	61.7	70	58	6.0	5.21	7.2	13	4,885
Shabani	906 5	...	95	54	82.8	63.1	72.9	...	71.8	64.4	67	60	5.2	2.19	4.6	8	3,192
Sinoia	887.2	...	89	55	80 5	61.4	71.0	...	71.0	64.3	70	61	4.4	4.42	6.8	14	3,793
Sipililo	884.3	...	85	55	78.0	61.5	69.7	...	70.7	63.9	70	60	5.4	4.47	6.1	7	3,875
Umtali...	892.5	891.9	89	51	79.4	60.2	69.7	71.9	70.4	64.2	72	61	5.5	3.82	5.3	12	3,670
Wankie	925.5	...	95	64	86.0	67.4	76.7	...	74.7	67.1	68	63	5.7	2.49	4.8	10	2,566

Rainfall in December, 1933, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
1	30	4	2	...	...	...	...	...	20	40	50	34	95	32	75	14	2	...	...	...	...	...	...	...	13	...	...	...	...	...	2	413
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3	100	122	1	...	...	...	...	...	...	104	16	2	1	98	66	15	22	25	1	...	...	...	...	1	21	1	...	...	...	...	...	596
4	56	38	1	...	..	...	...	7	12	35	25	4	111	24	50	48	6	1	...	..	...	...	...	5	16	...	...	...	...	...	9	448
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6	74	69	20	...	...	...	...	11	...	27	48	...	14	45	26	80	...	...	...	...	...	...	...	...	20	...	...	...	...	3	1	438
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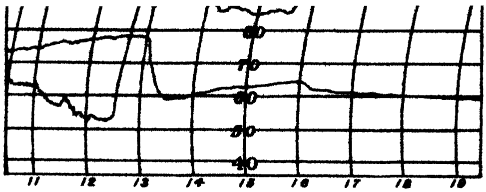
8	114	91	36	5	...	...	...	...	4	23	3	8	2	8	7	87	52	1	1	...	...	...	7	19	56	1	...	...	...	1	...	526
9	60	120	14	5	...	...	...	...	...	65	6	...	...	8	...	102	72	8	1	...	...	...	19	15	30	...	3	...	...	...	...	528
10	88	5	...	...	...	...	...	...	31	5	...	55	...	42	...	92	20	...	...	...	...	...	...	2	128	...	...	...	...	7	...	475
Mean	63	36	7	2	...	...	...	4	9	42	24	18	32	26	47	60	19	3	—	...	...	...	3	5	23	1	—	...	...	2	2	430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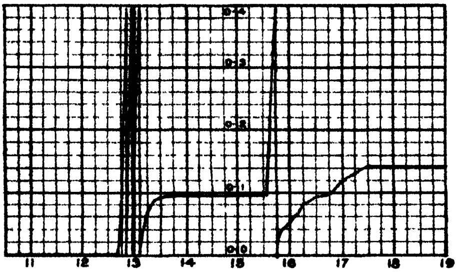
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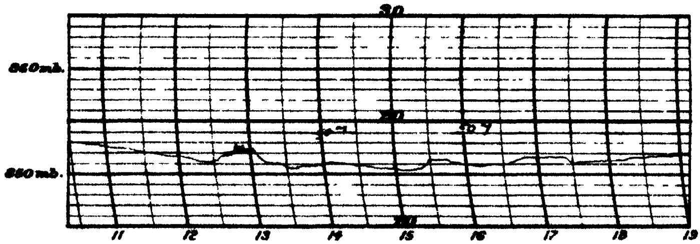
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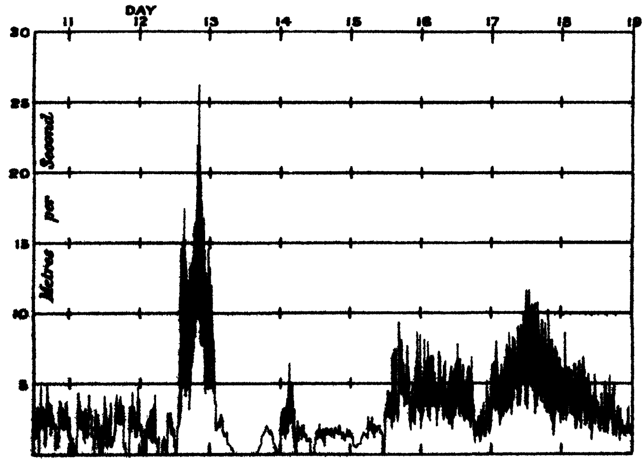
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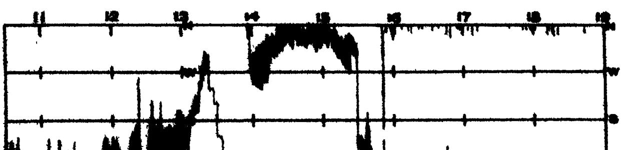
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Farming Calendar.

FEBRUARY.

BEE-KEEPING.

In most part of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due. which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, *i.e.*, to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees. either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month. and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See *Rhodesia Agricultural Journal*, December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of goards. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur. dianthus and pentstemon. The uower garden should be now looking its best, nearly all

plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions. carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, *i.e.*, pines, cypresses and calitris, and seed of these species should be sown for the following season's planting.

GENERAL

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition. but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better priçe. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season. all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun. and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand. etc., covering the floor of it, is available. it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk, are the chief reason sfor non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially

in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition, and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months. frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheese-making, and great care should also be taken of the starter. If this latter shows any signs of gassiness or develops any diagreeable flavour or colour, it hould be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

MARCH.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watchinig also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until the latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles *at once*. Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1¼ ozs., treacle ¼ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbages and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Expert. This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates An ample supply of clean water should be provided in the calf run.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy eeason tapers off in an irregular and often erratic manner and without certainty.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 374. Fibre Crops—Deacan Hemp (Hibiscus Cannabinuc) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
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No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
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METEOROLOGICAL.

No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.

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No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.

No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

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No. 554. Pisé-de-Terre, by P. B. Aird.

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No. 702. Book-Keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.

No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.

No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor-General.

No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.

No. 858. The Softening of Waters, by the Division of Chemistry.

How to Make Use of the Fencing Law.

Twelve Simple Rules for the Avoidance of Malaria and Blackwater.

Summary of the Game Laws of Southern Rhodesia.

No. 788. A List of Plant Diseases occuring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

No. 902. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.

No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Division.

No. 910. The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F. Duguid, M.A., B.Sc.

FARMERS' WANTS.

Advertisements under this heading will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words. The charges for these advertisements must be prepaid, and advertisements will appear on this page each month.

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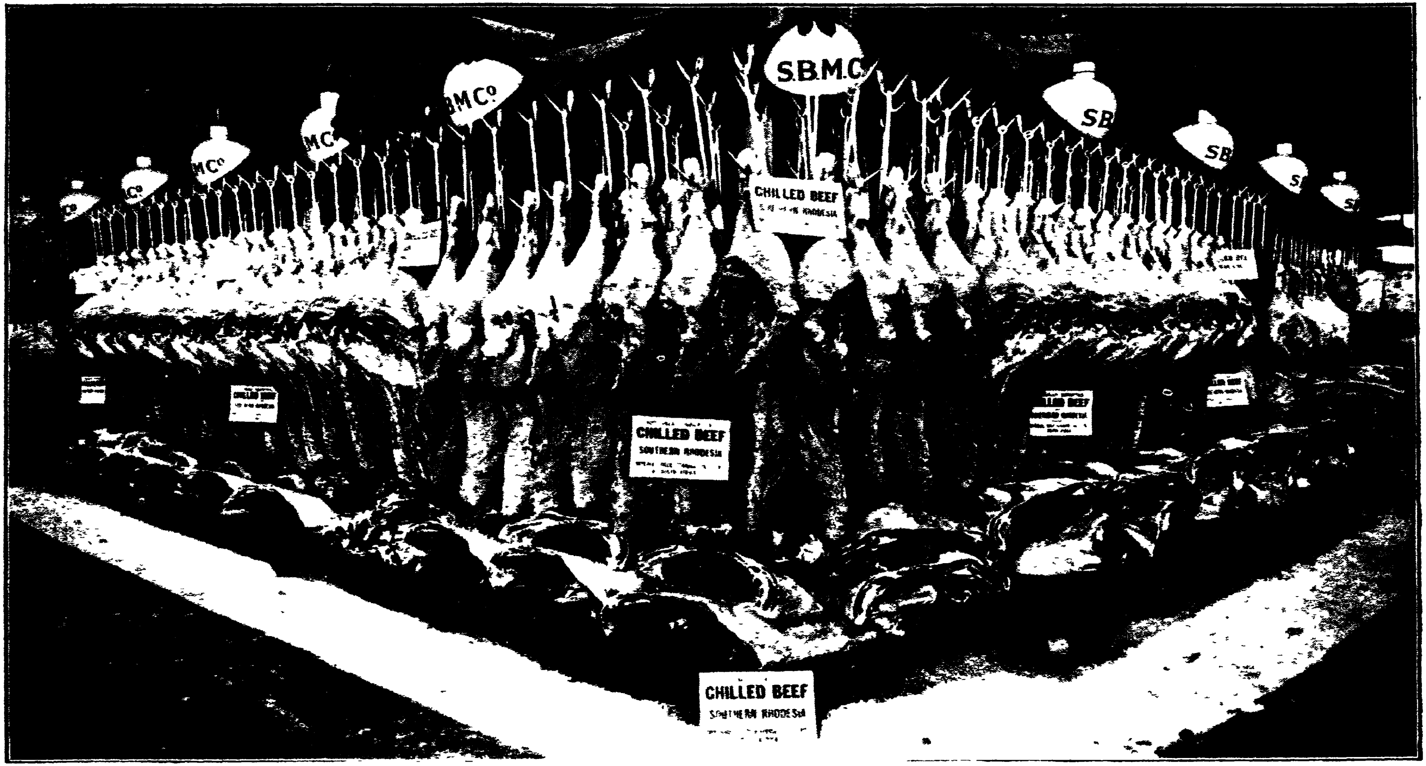
Our BUTTER WRAPPERS are guaranteed free from impurities and are printed with waterproof ink.—Art Printing Works, Ltd., P.O. Box 431, Salisbury.



Matopo Xmas Consignment of Chilled Beef at Smithfield.

THE RHODESIA

Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant, Department of Agriculture, Salisbury.

VOL. XXXI.] MARCH, 1934. [NO. 3

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Official Notice.—Tobacco Levy Act of 1933.—The attention of those concerned is drawn to the provisions of the Tobacco Levy Act 1933, and the regulations published under Government Notices Nos. 729 and 741 of the 24th November, 1933, which provide for the payment of a Levy of one-twentieth of a penny per pound in respect of all tobacco reaped in the calendar year ended 31st December, 1933, to the Accountant, Division of Agriculture and Lands, P.O. Box 373, Salisbury.

Attention is also drawn to Section 12 of the Act, which reads as follows:—

> 12. Any person who contravenes or fails to comply with the provisions of this Act or of any regulation issued

thereunder shall be guilty of an offence and liable on conviction to a fine not exceeding £50 or in default of payment to imprisonment with or without hard labour for a period not exceeding six months.

Imperial Agricultural Bureaux. New Chairman.—The Executive Council of the Imperial Agricultural Bureaux has elected Sir Charles Howell Thomas, K.C.B., K.C.M.G., the representative of the United Kingdom on the Council, as Chairman in succession to Mr. F. L. McDougall, C.M.G., the representative of Australia, whose period of office has expired.

The Locust Position.—The campaign against locust hoppers is proceeding steadily in all districts of the Colony. In most districts the position is apparently well in hand, but in some sand-veld areas which have sustained exceptionally heavy outbreaks, the outlook is less encouraging. Up to the present no reports of extensive damage to European crops by hoppers have been received, and it appears likely that the main maize crop will not be seriously affected by young locusts. On the other hand, however, the danger from flying swarms is greater than it was last year. Native crops have been damaged to some extent by hoppers in some localities.

Winged swarms of the Red Locust are still present in a few areas, and egg-laying is still being reported from certain districts. These winged swarms have done considerable damage where they have been prevalent.

This season the egg-laying period of the Red Locust has occupied more than three months, from about 10th November to the middle of February.

Hoppers hatching from eggs laid in early February will probably not appear until about the middle of March, and with the falling temperature the period of development of the

hoppers until they obtain wings cannot be stated. The usual period is about ten weeks in warm summer weather. The fate of these late egg deposits, particularly of any hoppers which hatch from them, is regarded as uncertain.

The most disquieting feature of the present position is the fact that, owing to the warmth of the soil and of the weather, the average period of incubation of the eggs was shorter this season than last, and the development of the hoppers seems to have been more rapid. Red Locust hoppers in the sixth stage have already been received from the low-veld, and it is certain that swarms of this species will obtain wings before the end of the month. During March the greater proportion will attain maturity and may cause considerable damage. Last season the Red Locust did not commence to attain maturity until near the end of March. Breeding during the present season is thus about one month earlier.

Apparently small numbers of Tropical Migratory Locust have already obtained wings in several districts.

It therefore behoves everyone concerned to make preparations immediately for the defence of crops against winged swarms. A very real danger exists owing to the earlier development of the swarms. Much maize will still be susceptible to serious injury when the winged swarms are prevalent in March. Winged locusts occasionally cause damage to tobacco and other crops.

Elsewhere in this issue will be found particulars of the means recommended to protect crops from flying swarms of locusts.

Irrigation and Soil Erosion Enquiries.—During the last few years the number of enquiries received from farmers in regard to soil erosion and general irrigation matters has increased considerably, and every dry season a number of farmers are disappointed. With the staff available it is abso-

lutely essential that all enquiries in the same district should be dealt with at the same time, and farmers are, therefore, urged to submit their applications as early as possible.

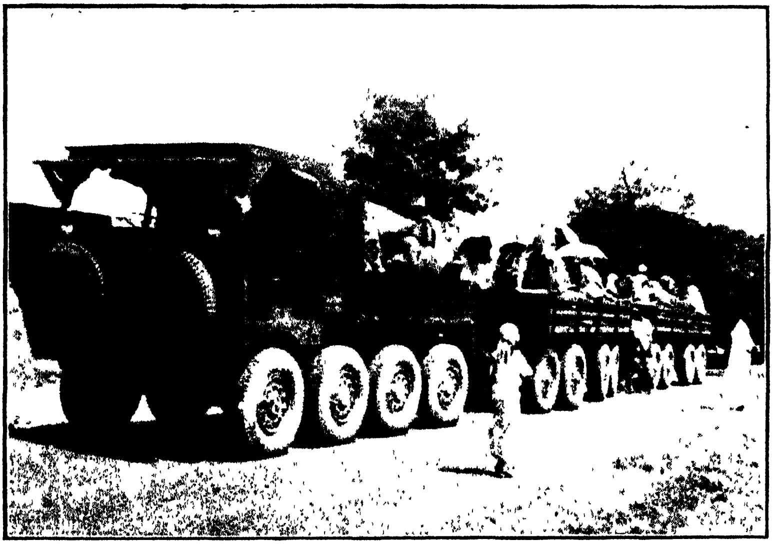
Motor Transport Unit for the Colonies.—A report has just been received from the Oversea Mechanical Transport Directing Committee, giving particulars of a 15-ton unit which has proved successful in the Gold Coast.

The Oversea Mechanical Transport Council and their Directing Committee were brought into being as a result of the recommendations of the Colonial Office Conference of 1927, and financed partly by contributions from twenty-three oversea Governments and partly by the Empire Marketing Board. The chief aim of the Directing Committee was to put forward a vehicle, or series of vehicles, to carry a heavy useful load on earth or lightly constructed roads, the cost of operation and the damage to the road to be as small as possible. It was recognised that roads oversea must generally be cheaply built, and, what is equally important, that they must cost as little as possible to maintain. Against this, the heavier the load that can be carried the cheaper is the cost of transport.

The tractor was manufactured by Messrs. Leyland Motors Limited, and the trailers by Messrs. R. A. Dyson & Co., Ltd.

The whole unit weighs approximately 31 tons and the load from 15/20 tons. It has now been used for nine months in the Gold Coast, and the distance travelled is 8,050 miles. Owing to the general financial depression, however, it was not possible to secure a full load during the test, and the average load was, therefore, only 8.6 tons.

In spite of these drawbacks the nett transport cost of the freight carried was 5½d. per ton mile. It is estimated that, had crude oil been used instead of petrol, the cost could have been reduced by approximately 20 per cent.



Unit with load of native passengers and freight

Ordinary commercial loads were handled, such as barrels of cement, concrete culvert pipes, timber and bags of salt on the journeys northwards, whilst agricultural produce, including millet, kolanuts and cacao, as well as native passengers and livestock, comprised most of the loads on the southwards journeys. As many as 150 sheep were carried on one journey.

An experiment was carried out in order to gauge the capabilities of the unit for carrying troops, and it was found that 100 rank and file of the Royal West African Frontier Force, with their arms, ammunition and machine-guns, could be transported at once.

Final Report Gwelo Municipal Demonstration Station.—Elsewhere in this issue is published the final report of the Gwelo Municipal Demonstration Station.

Through the co-operation of the Gwelo Municipal Council, arrangements were made for the conducting of two crop demonstration stations on the Gwelo Commonage. The red soil area is situated next to the rifle range, and near the level crossing on the Gwelo-Selukwe road. It is ten acres in extent, and divided into twenty half-acre plots. Its soil is representative of the heavier red soil areas of the Midlands. The sand veld area, situated on the Bulawayo-Gwelo road, and next to the golf course, is twelve acres in extent, and is divided into twelve one-acre plots. Both these stations are within two miles of the centre of the township.

Work on the stations was commenced in June, 1923, when the initial breaking of the land on the red soil area was commenced. A year later the sand veld area was opened.

The presence of an experiment station in the Midlands, where the effect of various methods of cropping have been observed, has proved of great assistance to the Department in advising on questions of arable farming in that portion of the Colony.

Thanks to successive Town Councils, and the ratepayers of Gwelo, the red soil station has completed ten years of very useful work, operations on it being closed down after the last harvest.

The general crop experiments on the sand veld area were also discontinued. The whole of the latter section, twelve acres in extent, has been placed under spineless cactus, and the more promising species of pasture grasses and herbage plants. It will thus serve as a demonstration of the suitability of these plants to the poor sand veld areas of the Midlands.

The grateful thanks of the Department of Agriculture are accorded to the ratepayers of Gwelo, to the various Municipal authorities concerned, and to the officials of the Council, without whose continued interest the station could not have been maintained.

IMPORTANT NOTICE!

WINTER FEED.

It is probable that the rainy season is drawing to a close and that in many areas the grasses have already passed their best stage for making a nutritious hay. In areas where the grass was slow in getting away, however, hay of good feeding value may still be cut.

The danger from locusts is still with us and winter crops and grazing are liable to suffer seriously from this cause. The Department therefore urges all farmers to lay in the largest possible supplies of winter feed of all kinds without further delay.

Poisoning of Stock by Sorghums

WHEN FED IN THE GREEN STATE.

During the present season one farmer has unfortunately lost two or three head of oxen, owing to their breaking into a field of young sorghum grown as a trap-crop for witch weed control. It would, therefore, appear advisable to reiterate the warnings given in the past concerning the danger of feeding the sorghums in the green state, since sorghums are being used widely by maize farmers now for trap-cropping witch weed.

All the sorghums, and this includes the kaffir corns, amber cane, Sudan grass and Johnson grass, under certain conditions, may contain the strong poison, prussic acid or hydrocyanic acid. The presence and the amount of the poison in these crops varies with the age of the plant, the conditions of growth, and the variety. The amount is greatest in young plants and gradually becomes less as normal plants reach maturity. However, the amount in older plants varies with the conditions of growth, and is greatly increased if they are checked or stunted by drought or frost, or if the plants are growing in hot dry weather. The aftermath growth, when sorghums are cut for hay, or silage, is always dangerous to stock.

The amount of prussic acid varies with the variety of sorghum. The kaffir corns commonly grown for grain in Southern Africa contain most, amber or orange sorghums contain less, and Sudan grass contains least of all. It is very rarely that pure Sudan grass has been known to cause death, but when crossed with other sorghums, the danger is increased. It crosses freely with all other sorghums. It is said that after normal growth Sudan grass may be fed green with safety to cattle and sheep, after the flower heads commence to appear, *but even then it should be fed with moderation and care,* and they should never be turned into a field of this crop hungry, to glut themselves. It is considered safe

as a pasture crop for cattle in Kansas after it has made forty-five days' growth, and is largely used in the United States of America for that purpose.

Different kinds of stock are not equally susceptible to this form of poisoning. Horses and pigs are said to be immune to it when pastured on sorghums in the green state. Sheep are slightly less susceptible to it than cattle, but the latter are highly susceptible.

Safe as Hay or Silage.—The prussic acid almost entirely disappears when sorghums are properly cured as hay, and in this form are practically always safe to feed. As silage, the sorghums are always safe to feed, as the poison is destroyed during the process of making.(2)

The poison is present in the form of complex compounds known as glucosides, which must be first broken down by certain enzymes present in the plant to liberate the free prussic acid.

Despite the danger of poisoning by green sorghums, which has necessarily been stressed above, very large acreages of sorghums are grown in South Africa, and more particularly in the United States of America, and in the State of Kansas it is the most important crop for stock feed, more than 3,000,000 acres of sorghums being grown annually.(1).

(1) Bulletin 265: Kansas State College of Agriculture: July, 1933.
(2) Henry and Morrison.—Feeds and Feeding, 1928.

The Export of Chilled Beef
FROM SOUTHERN RHODESIA IN 1933.

By Dr. A. E. Romyn, Chief Animal Husbandry Officer.

To appreciate the development of the trade in chilled beef from this Colony it is necessary to have some idea of the conditions which obtained in the United Kingdom market during 1933.

United Kingdom—Normally Great Britain imports half of her requirements of meat. The actual proportions imported in 1930, the last "good year," were:—

Beef	44%	of total supplies
Mutton and lamb...	57%	,, ,,
Bacon, ham, pork...	50%	,, ,,

The year 1933 was marked by a slump in the prices of home killed beef. A severe drop in the value of chilled meat occurred before this, during 1931, but since then, despite fluctuations, the level of prices for chilled beef has remained more or less the same. In November, 1933, however, home killed beef reached pre-War levels, though costs of production remained considerably above pre-War figures.

The imports of meat were consequently restricted in an attempt to arrest the fall in prices and all the major sources of imported meat, including the Irish Free State, are now controlled either by definite quotas or by "gentlemen's" agreements. During 1933 these restrictions had apparently little effect on the price of either chilled or home killed beef, though they may have prevented any further drop in the price of imported beef.

In 1934 it is anticipated that the effects of these restrictions will be greater as apparently some evasion of the spirit, if not the letter, of these agreements occurred in 1933.

In actual fact, however, imports of all meats in 1933 were 121,000 tons, or 7% less than those in 1932; all the principal descriptions, except frozen beef, sharing the reduction.

The reason for the continued fall in the price of home killed beef in 1933 despite this restriction in imports has been ascribed to:—

1. The unseasonably hot summer which discouraged the consumption of beef;

2. A bad grazing season on account of drought which led to the marketing of a large number of unfinished cattle;

3. An actual decreased per capita consumption of beef.

From 1927 to 1932 the annual per capita consumption of beef in England fell steadily from 69 lbs. per head in 1927 to 61 lbs. per head in 1932—a decrease of 8 lbs.

Over the same period the per capita consumption of mutton and lamb rose from 27 lbs. per head to 32 lbs. and bacon from 40 lbs. to 49 lbs.

The decrease in the amount of beef consumed represents the product of 600,000 head of cattle, and it seems clear that the market will no longer absorb beef on the scale of five years ago.

Southern Rhodesia.—The Veterinary returns of meat exported up to December 31st show that 90,004 quarters of chilled beef, weighing 12,875,711 lbs. were exported from Southern Rhodesia in 1933. This represents 22,501 head of cattle. The exporters, The Rhodesian Export and Cold Storage Co., were successful in maintaining continuity of supplies from the start and in delivering the meat in good condition in England.

From cable advices the average weekly gross sale prices per consignment were 1.99d. per lb. for fores and 3.806d. per lb. for hinds, and assuming an equal weight of fores and hinds the average price of 2.89d. per lb. was realised for sides.

Taking the value of offals at Bulawayo at .33d. per lb. and the total costs of preparation and marketing at 2d. per lb. the nett value of the beef at Bulawayo was 10/2d. per 100 lbs. dressed weight.

The average dressed weight of the bullocks exported was 572 lbs. The nett value per bullock on this basis at Bulawayo would, therefore, be £2 18s. 1d., exclusive of the bounty.

This figure is below the general cost of production of steers of the type exported, and a change will have to be made somewhere if trade is to continue to function on its own resources. Alternative courses possible are:—

1. To subsidise the trade until the price of chilled beef returns to a more remunerative level;

2. To reduce materially the costs of production or marketing;

3. To improve the quality of the beef shipped and so obtain a better market and higher prices.

The first course has the support of a considerable body of farming opinion in this Colony.

During the period July to December inclusive, grass fed Rhodesian chilled beef sold at 1.54d. per lb. for sides below the average of first and second grade Argentine chilled beef. Actual consignments, dependent chiefly on the quality of the meat, sold at from 1.12d. to 2.44d. per lb. below these Argentine levels.

It is held, therefore, by the supporters of the bounty that if the average price of Argentine beef returned to 1930 levels (5¼d.—6¼d.) for sides, *and competition were restricted*, Rhodesian beef, as now produced, could be sold in England at a useful profit.

Such a rise in prices is not really anticipated by the trade, and the "*laissez faire*" policy of simply waiting for

"something to turn up" is a dangerous one and will not put producers in a better position to compete with the larger supplies which would normally follow such a rise in prices.

The second course, that of reducing costs of production and marketing, would not produce tangible results in sufficient time. Most producers maintain now that they have already cut their costs to the bone. It is, nevertheless, an essential and possible supplementary measure in any campaign of action.

The third alternative, that of improving the quality of the meat marketed, is the obvious course to follow if it can be shown to be payable under our conditions. Marketing costs are high on account of the inland situation of this Colony and much of the country is not fertile. Cheapness of production, is therefore, essential and methods which would be successful elsewhere may have to be ruled out here.

Supplementary feeding of the bullocks before export and of the weaners is the quickest way to effect a great deal of the improvement required. It has still to be proved, however, that this supplementary feeding will pay. Comparatively few stall fed cattle were sold during 1933, and representative figures are only available for the three fairly large shipments in December last.

The grass fed cattle in these three consignments were uniform. The "stall fed" cattle, however, varied from very poorly finished bullocks to the bullocks in the Matopos Xmas consignment, which were described by the agents as "completely satisfactory and representing the ideal in quality both in distribution and quantity of fat." The prices realised were:—

Special stall feds...	3.84d. per lb.
Ordinary stall feds	3.22d. ,,
Grass feds...	2.77d. ,,

In general terms, the return from the special "stall fed" animals should, under present circumstances, almost cover all the costs of production, but would leave no profit to the producer, exclusive of the bounty and manure. Fifty per cent. of the Matopo Xmas consignment sold, however, at 4.18d.

per lb., and this price should leave a small profit on the whole transaction, exclusive of any bounty or manure. The result of this particular consignment was one of the brightest spots of the year. (See frontispiece.)

The increase in value of the ordinary stall fed animals should about cover the cost of feed, leaving the manure as profit, but not the cost of production of the store bullock. The grass fed animals sold at substantially below their cost of production.

"Stall fed" bullocks in small numbers were sent over in twelve other consignments. The results were variable, depending on the comparative qualities of the "stall feds" and "grass feds" in the particular consignment. Some of the "stall feds" were very poor. In a few cases there was practically no difference between the sale prices of the "stall fed" and "grass fed" cattle, but on the average of the twelve consignments the increase in value (approximately ½d. per lb.) of the fed bullocks would have paid for the cost of feed, leaving the manure as profit. The figures clearly show that good feeding is comparatively much more profitable than poor feeding and that to just "warm up" a bullock is little use, unless it is nearly prime to start with.

Though so far the increase in value of the steer has more than paid for the cost of feed, far more data will be required to prove the matter definitely. More information will be available within the next few months. It is realised meanwhile that, unless a profit can be shown on the combined enterprise of raising the store and the feeding of it, fattening will come to an end with the disappearance of the present supply of store bullocks. This need not, however, deter the feeding of cattle during 1934 as, with the bounty paid on "stall feds," the fattening should show a good profit.

It must be emphasised here that the conviction that an improvement in quality and supplementary feeding will be necessary to establish Rhodesian beef on the English market, and that, if this cannot be done profitably, prospects for a permanent trade are poor, is based more on the observations made of the market in England during the summer of 1933 and on subsequent reports than on the sales returns of this

year. All trade reports stress that, as the proportion of "stall feds" increases and buyers feel safe of a continuity of supply, the present margin in prices between "grass feds" and "stall feds" will widen materially.

Prospects for 1934.—1933 was a bad year for the beef producer, and it is generally anticipated that the measures taken to regulate the industry will result in an improvement in prices during 1934. Many more bullocks will be fed this year than last, and with the promise of a record grazing year year in the Colony during 1934 the quality of grass fed cattle exported should show an improvement on that of 1933 and realise proportionately better prices. No great rise in prices can, however, be reasonably anticipated until there is a general improvement in world trade conditions.

The Tobacco Pests Suppression Act, 1933

AN OUTSTANDING INSTANCE OF THE RESULT OF NEGLECT OF TOBACCO LANDS.

By RUPERT W. JACK, Chief Entomologist and Chairman, Plant Regulatory Board.

Part II. of the Tobacco Pest Suppression Act, 1933, provides for the compulsory uprooting and destruction of all living tobacco plants by a date to be fixed by regulation.

The object of this measure is to reduce the facilities for overwintering of serious tobacco pests, particularly the Tobacco White Fly (*Aleyrodidæ*), which transmits the virus disease known as Leaf Curl.

By Government Notice No. 367 of 1933 and the further amending Government Notice No. 742 of 1933, the dates for the destruction of growing tobacco plants are fixed at August 1st in each year in the case of Virginia tobacco, and September 1st in the case of Turkish tobacco.

An instance was reported by Mr. W. L. Williams, Tobacco Pest Inspector, during January, in which a farmer who did not propose to use the land during this season, had apparently contented himself with cutting down the tobacco plants last year, and these had, of course, grown up again.

His neighbour in due course planted a piece of land about one hundred yards away, without taking adequate steps to inform either the Police or the Department of Agriculture of the presence of ratooning plants so close to his land on the adjoining farm.

The position was investigated by Dr. J. C. Hopkins, Plant Pathologist, and Mr. Williams, on the 25th January.

The plants in the abandoned land were found to be heavily infested with White Fly, and heavily affected by Leaf Curl disease.

The newly planted land on the adjoining farm, one hundred yards away, was also considerably infested with White Fly, the infestation being heaviest towards the side nearest the abandoned land, and decreasing towards the further side, indicating the source from which infestation had been contracted. About fifty per cent. of the tobacco plants on this land also showed Leaf Curl and were obviously more or less useless.

Other lands at greater distance were less affected, and the occurrence of both White Fly and Leaf Curl diminished with the distance from the abandoned land until none could be found.

This instance illustrates not only the necessity for the measures which have now been given the force of Law, but also the necessity for closer co-operation between tobacco farmers and the Department.

Several cases of neglected tobacco lands have been duly brought to the notice of the Department by neighbouring farmers since August, and in each case steps have been taken to ensure that the plants were up-rooted and destroyed before they could become a menace to any neighbouring crops.

European members of the B.S.A. Police have all been gazetted as Inspectors under Part II. of the Act (see Government Notice No. 547 of 1933) and any complaints should be addressed either to the local Police or to the Department, when suitable action can be relied upon.

During the past year no prosecutions have been instituted under the Act, as certain farmers may not have grasped its provisions fully, in spite of the fact that every effort was made to acquaint all tobacco growers with the regulations, a copy of the Government Notice being forwarded to all farmers known to grow this crop.

In the event of neglect to clean up lands in accordance with regulations during the present year, there will be no alternative but for the Department to prosecute any offenders.

It is pointed out that neglect to destroy tobacco plants by the dates specified is to jeopardise the crops of any neighbouring farmers, and to run the risk of causing them serious financial loss, as in the instance cited above.

On the other hand the planting of a crop anywhere near neglected lands is to exhibit a lamentable lack of care for one's personal interests, particularly in view of the fact that a message to the Police or the Department will supply the remedy.

White Fly and Leaf Curl obviously constitute a very serious menace, and tobacco growers will be well advised in their own interests to assist the Department in every possible way to ensure that the provisions of the Act are complied with by all.

The vast majority of tobacco growers during the past year have, of course, fulfilled their obligations under the Act in a satisfactory manner. The principal danger apparently lies with growers who are abandoning their lands and have lost interest in the crop. No case of neglected lands has been reported in which the offender was occupying his farm with the intention of growing tobacco during the current season.

LOCUSTS.

By the DIVISION OF ENTOMOLOGY.

INSTRUCTIONS FOR DEALING WITH FLYING SWARMS.

By THE DIVISION OF ENTOMOLOGY.

Flying locusts constitute a serious menace to farmers and ranchers. The majority of Red Locust hoppers which have escaped destruction in Southern Rhodesia will become fliers while crops and pastures are still green enough to attract them, that is, from the end of February onwards. Swarms of flying Red Locusts bred both in Southern Rhodesia and beyond our borders will, no doubt, continue to traverse the Colony throughout the dry season and constitute a potential threat to winter crops and grazing. The only practicable procedure is for each farmer to prevent the locusts as far as possible from settling on his lands, or, if they have settled, to drive them off.

Scaring.—Scaring methods, while primitive, are frequently very effective, although at times swarms may be difficult to dislodge. Banging of tins and creating disturbance by other means such as discharging of firearms, waving of brightly coloured flags, etc., where the locusts threaten to settle or have settled may be sufficient to drive them away.

Smudge Fires.—Materials for producing quick smudge fires and maintaining these for some hours should be kept in position around the lands, with special attention to the side towards the prevailing winds. Further material, which, on burning, gives off a dense and pungent smoke, should be placed in readiness when swarms are believed to be approaching. Green wood with leaves attached and wet straw are

useful materials for placing on the fire when it has been lighted, but, of course, any other suitable material that is available can be used.

The fire should be lighted on the leeward side, and fresh green and moist material piled on top on the windward side as the fire burns. Combustion should be slow, and on no account should flames be allowed to break through the wet blanket on the top. A properly constructed fire should burn slowly for several hours. The best form for a smudge fire is probably a long low heap, with the long axis parallel to the line of the prevailing wind. A round pile will probably break into flames too readily.

The addition of heavy petroleum oil, spent lubricating oil, coal tars, etc., to a smudge fire will greatly increase the column of dense smoke. The oil should be applied on the wet material in small quantities on the windward side.

Kenya Method.—In Kenya a very satisfactory smoke screen has been produced by injecting waste oil into the exhaust box of an internal combustion engine, tractor, etc. This method, it is stated, "has the advantage of delivering a continuous curtain of smoke and can be applied on the most suitable line according to the direction of the wind at the time." It also eliminates the risk of firing crops.

The following directions for making smoke screens from an internal combustion engine are given by the Department of Agriculture, Kenya:—

"The exhaust manifold is drilled and tapped to take a small cock into the end of which is brazed 8 in. or 12 in. of about 5-16 in. copper tubing. The purpose of this is to keep the rubber tubing which leads to the fuel supply insulated from the heat of the manifold. The fuel supply can be either of two types: (1) Gravity feed; (2) forced feed.

"(1) The gravity feed is the simpler, and consists merely of a four-gallon drum or any other receptable strapped to the tank or any other convenient part of the tractor. The rate of feed can, of course, be varied to some extent by adjusting the height of the fuel container above the point of injection into the manifold.

"(2) The pressure system consists of two four-gallon drums connected by a piece of copper tubing, with a cock at the centre. One drum, the fuel container, has a delivery pipe at the bottom, while the other, the air pressure container, is fitted with an ordinary motor-tyre valve. Pressure is created in the air container by means of an ordinary motor tyre pump, only a few pounds being required. By opening and closing the valve between the two containers the amount of fuel delivered to the manifold can be adjusted for the maximum volume of smoke.

Method Preferred.—"The method described in paragrph (2) is considered preferable to that in paragraph (1), as the rate of injection can be adjusted at will.

"The following points should be noted: (1) Do not drill the manifold in such a place that the fuel on being injected would tend to come into connection with the carburettor heating system. (2) In the pressure system all joints must, of course, be airtight. (3) The tractor must be thoroughly hot before the injection is made. (4) In order to keep the tractor hot while the screen is being laid, it should be kept on load, if possible, by pulling such an implement as a disc harrow."

Chemical Smudges.—The following formula for a chemical smudge has previously been recommended:—

Saltpetre	30 parts.
Sulphur	12 parts.
Borax	8 parts.
Coal tar	25 parts.

The saltpetre, sulphur and borax should be in fine powder or should first be ground; they should be thoroughly mixed, and then added to the tar (warmed if necessary) and thoroughly incorporated therewith.

A deep tin, such as a jam or coffee tin, should be filled three-quarters full of the tar mixture, and on top of this should be placed a layer of about a quarter-of-an-inch deep of priming mixture of the following composition:—

Saltpetre, sulphur and borax mixture as above	2 parts.
Sugar, fine white	1 part.

In compounding this mixture, it is essential that the saltpetre should be thoroughly dry; it is apt to absorb moisture from the air, and should therefore be dried in an oven and allowed to cool before mixing. In the centre of the priming composition a small quantity (just a pinch) of chlorate of potash (finely powdered) should be sprinkled, as this will enable the mixture to be ignited without any trouble. A few strings of cordite or some gunpowder out of a cartridge could be used instead for this purpose, or a blowlamp can be used for igniting the mixture. As soon as the priming composition is ignited, a lid of some sort can be put over the tin loosely. The priming mixture should burn fiercely, and in about 30 seconds a dense smoke should be produced; an ordinary jam tin, holding about $2\frac{1}{2}$ lbs. of mixture, will burn for about 12 minutes. If the mixture bursts into flame, a few handfuls of sand should be thrown over it to stifle the flames. There is no likelihood of it being extinguished when once fully ignited. It is of the utmost importance that the priming composition should be thoroughly dry.

Storing Mixture.—If quantities of the mixture are to be prepared some time in advance to meet possible emergencies, the two mixtures should be stored separately in airtight containers such as coffee or syrup tins, or in bulk in larger airtight containers. Should the mixture deteriorate it can still be put to some use by throwing it on to a smudge fire.

Another recommended formula consist of the following materials:—

Five-gallon drum coal tar.
100 lbs. bag of nitrate of soda.
50 lbs. sulphur.
25 lbs. borax.

This quantity is sufficient to fill 100 one pound coffee tins, and each tin should burn for 15 minutes.

These substances should be mixed as follows:—

Ten pounds of nitrate of soda should be taken out and kept in a dry place, the remainder, if damp, should be gently dried in an oven.

Powder the whole of the sulphur and borax and then mix thoroughly with the 90 lbs. of nitrate of soda. The latter need not be powdered but the lumps should be taken out.

Do not Grind these Three Materials Together.—Add the nitrate, sulphur and borax mixture to the tar and stir thoroughly. An eight gallon petrol drum with the top removed would be a convenient receptacle for the mixture.

Three-quarters fill small tins from the bulk. Any small tin will do, but deep ones (*e.g.*, 1 lb. coffee tins) are probably best. If the tins have lids, these should be pierced with nail holes; if they have not, a larger tin should be perforated and placed over the smaller tin containing the mixtures.

When required the tins should be placed out at intervals of 25 yards, and a small quantity, about a tablespoon of the dry nitrate of soda from the 10 lbs. originally reserved, should be put on the top of the mixture in each tin.

If the swarms appear likely to alight, ignite the priming mixture of nitrate of soda either with a blowlamp or with a fuse igniter.

Agricultural Research.

The Right Hon. W. Ormsby-Gore, M.P.

[The following article by the Right Hon. W. Ormsby-Gore, M.P., is taken from the January number of *The Journal of the African Society.*—Ed.]

Success or failure in agriculture, as in every other art or industry, depends on " comparative efficiency." The farmer succeeds or fails in proportion as he produces the better article, and produces it more economically than his competitor producing a similar article. The better quality product, produced in greater quantity to the acre, beats the inferior and less " economic " product off the market. And, as in industrial production, the race is never won. It is continuous and everlasting. Every day the research worker is breeding more efficient plants, is breeding and feeding a more economic domestic animal—success is to those in the vanguard of this perpetual progress: failure to those that lag behind. We cannot afford to resist this law of change or disregard the every-expanding discoveries of the scientific worker.

Organised agricultural research has usually begun as defence against plant and animal disease. Some pest or fungus attacks a crop and we seek the help of the bug hunters (entomologists) and mould fighters (mycologists) to protect our crops from these attacks, just as we go to a doctor when we are ill. Now, just as "preventive medicine," sanitation, etc., is seen to be more important than the cure of pathological conditions, so, in agricultural research, the best protection of plants and animals against disease is a robust constitution, and disease resistant factors, which can be bred or maintained by special feeding.

The bulk of the higher modern agricultural research work in the world has developed into three main types of scientific effort—the work of the geneticist or breeder, the work of the physiologist, and the work of the nutritionist or feeder. Perhaps I ought to add the "ecologist," the man who studies the environment of a plant or animal and seeks to establish what are its optimum conditions of climate, soil (in the widest sense), light supply, etc. Of course, the process of "seed selection," cross-breeding of animals, manuring of plants and special feeding of domestic stock, have always gone on in agriculture. But, nowadays, these often chancy or empirical advances of the past have been superseded by the more scientific, fundamental and long-range research of the geneticist and the nutritionist.

The agricultural research stations which seem to be making the most remarkable advances in new discovery—to be leading in the race for agricultural efficiency—are those "one-crop" stations, where a team of specialist workers concentrate on the improvement of the economic efficiency of one crop. In them—with the geneticist leading—the plant physiologist, the biochemist, the ecologist, the entomologist, the mycologist, set out to solve problem after problem with a view to producing new types and new varieties of greater economic efficiency than the existing ones, and of controlling or supplying the (often obscure) environmental conditions under which that efficiency can best be realised.

The scale and range of some of these stations is enormous, including as they do, not merely the creation of new varieties, but all the problems of manuring, irrigation, and improved technical handling of the crop. Probably the largest, and in many ways the most remarkable, are the new sugar beet and potato research stations in Soviet Russia. In the tropics, the research stations in Java, and especially the great sugar cane research station at Passaruan, are the most up to date and successful.

What both Governments and farmers frequently fail to realise is that we have now reached a stage of knowledge and experience in these matters where the making of further advances, as regards many of the world's staple crops,

involves the organised team work of many specialists over a series of years. The demand of the layman is for quick results for expenditure in research. This demand is often quite impracticable, and its mere existence has often diverted the team of workers from what they know to be the better, and ultimately more useful, but longer, piece of work, in favour of something shorter in time, but less important in result. For there must be no misunderstanding that the most important advances are nearly all the result of uninterrupted work on a problem, for anything from five to ten years.

Research is necessarily expensive. Not only is the whole apparatus of the agricultural research worker a fairly expensive business, but the worker himself has nowadays to go through a long period of University and post-graduate training, and, in order to keep up to date, has to be fed with literature and translations from contributions by other workers in the field in many different languages. And, above all, the supply of the really qualified men is pretty limited. There is somewhat of a vicious circle at present in this last matter. There are few men because there are few jobs offering. On account of the world-wide commodity slump, at this moment there are more men capable of good research work than there are jobs—at any rate in the British Empire overseas—a strange contrast to conditions obtaining a few years ago.

It is not easy to bring home to the average citizen of the British Empire, with his general and most universal tradition of literary and classical education, the significance of modern science. Even where he has included in his education some smatterings of modern science, his knowledge in the main is linked to physics and chemistry. For most British people biology is either a closed book or limited to a little botany or zoology. Some decimal of one per cent. may have heard of Pasteur—a smaller decimal of the Abbé Mendel. Genetics—even plant genetics—is still something under taboo as a school subject. Consequently the politician and the administrator, the Treasury Controller and the general public don't begin to know what the agricultural research worker thinks about. They don't begin to comprehend his

language, still less to understand the character of his work. This ignorance is a serious danger to the whole economic future of those parts of the Empire that are dependent on agriculture, and particularly on the export of agricultural products in competition with world markets. We are skilled in handling legal, transport and industrial problems, but tiros at modern biology. Our research institutions in the Colonial Empire are few, small and short of money and personnel. The few we have are good, especially the College and the Cotton Research Station in Trinidad. Trinidad in a few short years has already made a real difference: but we are behind the vanguard in the race and we cannot henceforth afford to leave it to the Dutch, the Russians and the Americans to lead us. We are already suffering in competition from a want of knowledge and a want of intelligent imagination in this whole subject. Our whole educational curricula have been based on an old stable civilisation and on conditions that are fast changing. The most serious gulf to be bridged is the intellectual gulf between the actual research worker and the people with power who alone can provide him with the support and opportunities without which the research worker cannot help them.

Notes on the Bulawayo Municipal Farm.

By R. Dickson, Manager.

METHODS OF IRRIGATION AND WORKING A HEAVY CLAY SOIL.

"The following account of methods used in irrigating and working land on the Bulawayo Municipal Farm should prove of the greatest interest to readers because it is thought many authorities would have been of the opinion that the irrigation of such a heavy clay soil would have proved unprofitable for the successful growing of lucerne, owing to the difficulty of maintaining a satisfactory physical condition of the soil, and to the plants' intolerance of water-logged conditions.

"It should be noted that Mr. Dickson emphasises the absolute necessity on such a soil, of only working it when in a thoroughly dry condition.

"The method adopted on this farm of applying water by irrigation to farm crops is, it is thought, unique in this Colony in so far that only three natives are required to irrigate some sixty-five acres, and they do this without having to wade in the water or having to lead the stream of water on to the land by the use of shovels, thus avoiding the danger of puddling the soil."—D. E. McLoughlin, Agriculturist.

Sixty-five acres are set out for irrigation to use 500,000 gallons, this being the average daily flow of effluent from the sewage purification works.

A portion is under Provence Lucerne, the remainder of the area being used for growing oats in winter. A crop of

maize is also grown in the summer months under irrigation. The land is ploughed *when thoroughly dry*, early in October, graded and planted to a quick maturing yellow variety of maize, which is hoed out early in March, and stooked off the land. Oats or barley-wheat are then sown, and harrowed in and rolled. *No ploughing is done at this stage*, as shallow work is necessary, because the moist soil a few inches below the surface must not be disturbed.

The irrigated lucerne beds are about 700 yards in length and 12 yards in width. The main slope of the land is to the north, and the beds lie across this slope with a slight fall to the east over the length of each bed. The main furrow passes along the ends of the beds in a northerly direction with a subsidiary water channel running along the upper side of each bed and a bolster or bank running along the lower side.

The water from the main furrow is let into these channels, which are about 2 feet in width and 6 inches deep.

Roads are made through the land at every eight beds for transport purposes.

An iron shutter is used to turn the water from the channel over the bed. This shutter is handled by one boy, who jams it in across the channel every 10 feet along its length. The water is thus turned over the bed, and when near the bank on the opposite side of the bed, he lifts and carries his shutter and jams it in another 10 feet down the channel and repeats the performance down the full length of the bed until it is completely watered. Better work is done by two boys using a shutter each as the second shutter placed at the correct distance beyond the first prevents the escape of water past the first one down the channel.

Light and rapid irrigations applied at frequent intervals are practised; this is the most important part in the application of water to this clayey soil. A fast flow is essential to cover the bed quickly, so that the water can ride on the "air

cushion" present in the soil, and not get down too deep and cool the subsoil. Heat is necessary to encourage the rapid growth of lucerne, a cold and damp subsoil retards it.

This would appeai sound reasoning, as some of the best growths of lucerne are to be found in Lower California, U.S.A., in valleys where probably some of the highest shade temperatures in the world are recorded.

From July until the rains set in in December, the lucerne is cut every twenty days, at an average height of approximately 2 feet. Growth is best during the hottest and dryest months. As much as ten tons has been cut from an acre on a twenty days' growth. This was weighed green on the land,

The lucerne is never allowed to flower, and it should be emphasised that the time for cutting is judged solely by the appearance of the new shoots at the crowns of the plants, and no attention is paid to the time of flowering or the height of the crop.

From seventeen to twenty-two days is about the period from cutting until the new shoots appear at the base of the plants.

If cutting is delayed, these become long and weak, white in colour, and get scorched on exposure to the sun—I have noticed when these new shoots are short when cutting takes place, that given a day to harden before a light watering, they make much more rapid growth.

The second watering is applied on the fifth day, the third and last watering on the twelfth day. The interval after the last irrigation leaves the ground fairly dry before the next cutting takes place, so that the soil is not packed by the labour working on the land.

Weeds and Rapoko grass take possession of the lucerne area during the rainy season, and the lucerne practically remains dormant during the wet period.

The irrigation crops are grown on a heavy red clay soil. It would be a hopeless venture to try and grow lucerne in such

a soil, once it has lost its texture or become *packed by having been tilled wet or even moist*, and expect the same crop returns recorded here.

The system of working soil *only when powder dry at all times* aerates the soil and "gives the earth a chance to breathe"—even when irrigating, my boys are not allowed to wet their shovels or feet, as their only job is to place the iron shutters in position; hence the absence of clods, and the entire absence of cracks in the lands.

The area under maize followed by oats for the third season having had millions of gallons of water, in addition to the season's rainfall will, when thoroughly dry at the end of September, be a *light friable soil to plough*, proving that at no time has this area been worked when wet. Not one clod appeared during the ploughing last season, of land which had been irrigated for two years.

On experiment, an acre of this soil, after ploughing and grading, soaked up, under slow irrigation, 900,000 gallons of water, equivalent to 40 acre inches, inside forty-eight hours, and no signs of "ponding" at any time, proving how light and spongy red clay soils can be kept. The results, therefore, support my system of dry ploughing and cultivation, and the absence of any plough pan. It is not necessary to turn the beds into a bog to grow crops. Quick surface watering avoids this great waste of water, and keeps some air in the soil; soils on other formations, of course, will behave differently, especially granite soils, since lucerne does well during our rainy months on these, but on red clay soils during wet weather just turns yellow and woody, and refuses to grow.

Original Preparation of the Land.—The Municipal Council was most fortunate to have this site for an irrigation farm; it was virgin country, heavily timbered. I don't think the natives bothered to cultivate this clay patch in the early days.

After clearing the timber above and below the ground, it was levelled and then broken up with a pan breaker, ploughed and left to weather down.

The pan breaker and ploughs were hauled by a caterpillar tractor. The pan breaker, a powerful implement set 15 inches

deep brought up no subsoil, it just pushed its chisel point through the hard earth, and dragged out the tree roots that were missed when stumping the land.

A summer-grown crop of velvet beans was cut up with a Killifer disc and ploughed under. Then a crop of sunn-hemp grown under irrigation which attained a height of over 6 feet, was dealt with in a like manner. After the ploughing under of the two green manure crops, a crop of oats was grown, which was reaped as forage.

The land when *thoroughly dry* was again ploughed, graded, and put down to beds and planted to lucerne, etc., and has received no other treatment up to date.

This farm, possessing modern implements for tractor farming, and conditions so favourable that good crops are the rule, serves to prove the value of irrigation in a district where green feed is so much sought after in the dry season, and in periods of drought.

In only use three boys to irrigate sixty-five acres, and the water flows day and night.

The labour, to cut by hand and tie 35,000 bundles of lucerne during last October, which was a peak month, consisted of twenty-five boys, and the work was done daily after 4 p.m., after the usual day's work on developing new lands.

I have seen fully developed farms in Ireland, Britain, France and the United States of America, Canada, Australia and New Zealand, and therefore our farms which remain undeveloped and uncompleted in layout suffer by comparison. Unless the layout is complete, it is impossible to satisfactorily carry out farming operations.

It must be understood that this farm is not nearly developed as yet, but with the additional improvements taking place each year, the time will come when it will compare with any agricultural venture in Africa. Up till now it has been no rest house, and there is many a nasty jerk coming to the plough yet.

The adjoining mining area will be a formidable job to tame and give an appearance suited to a modern farm.

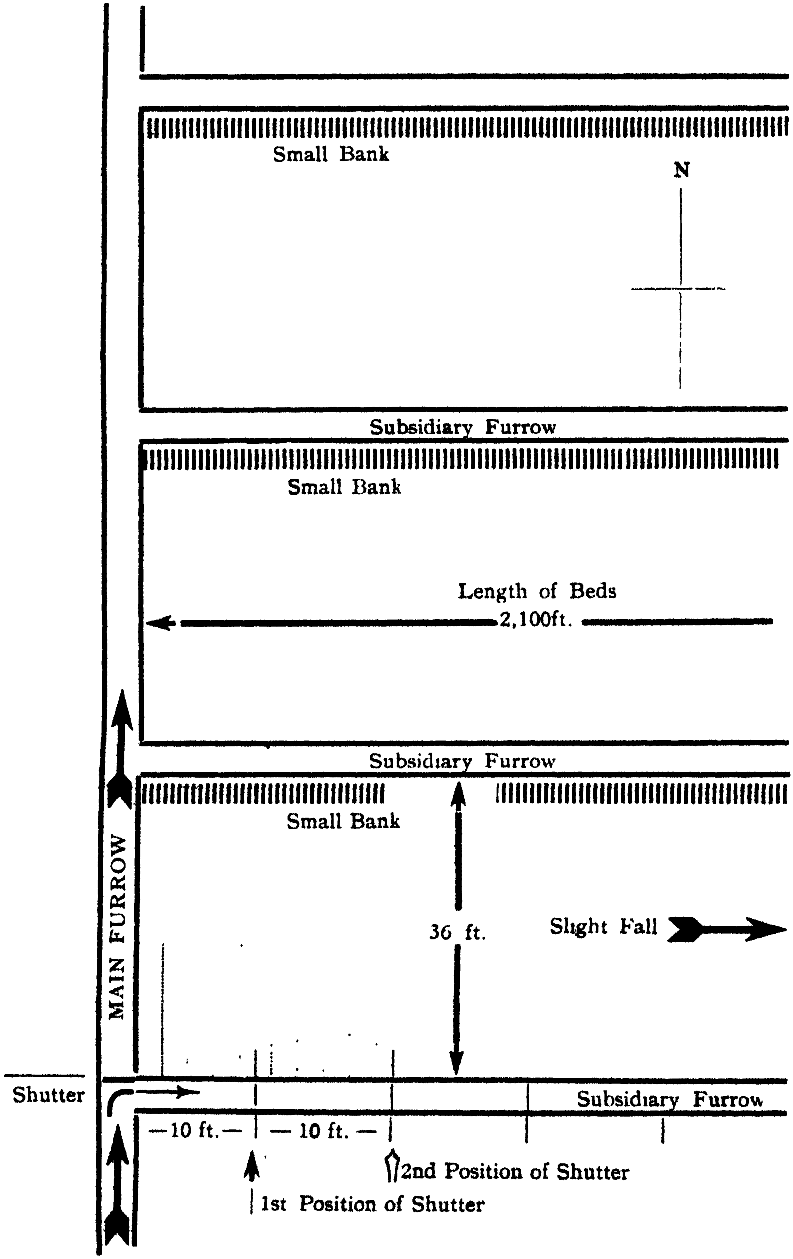
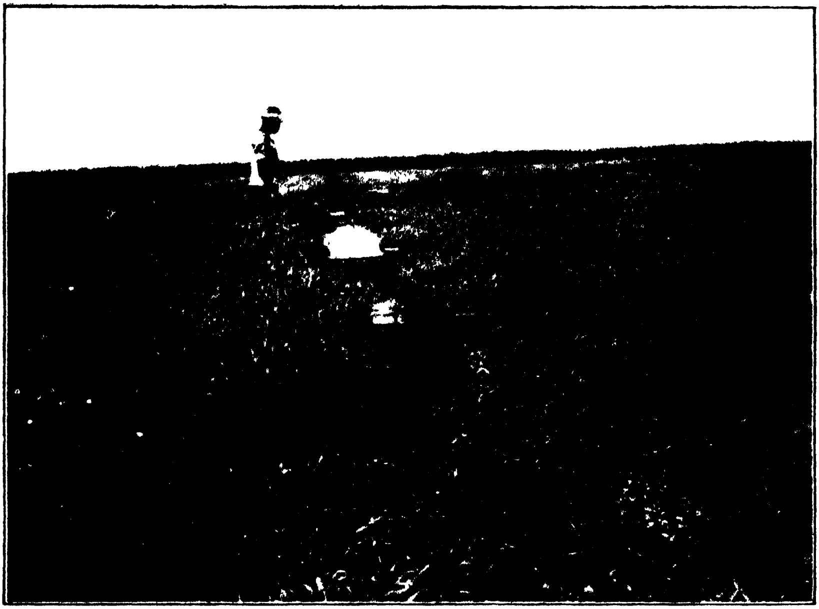


Diagram shewing lay-out of Lucerne Beds and method of irrigation, on the Bulawayo Municipal Farm



Iron shutters in position.

Main furrow and subsidiary channel.

Gwelo Municipal Demonstration Station

FINAL REPORT, 1933.

By S. D. Timson, M.C., Dip. Agric. (Wye),
Assistant Agriculturist.

From the rainfall records given below it will be seen that the average annual rainfall on the Red Soil Station area over the ten-year period is 25.05 inches, and on the Sand Veld Station it is exactly one inch less over a period of seven years. However, if the two seasons in which the rainfall exceeded 34 inches on the Red Soil Station be excluded, the average annual rainfall for the remaining eight years is only 21.15 inches. It will then be realised that the various crops and cropping systems demonstrated on these stations have received a severe test.

This has proved too much for the oat crop. but many other crops such as maize, ground nuts, sunflowers, velvet beans, dolichos beans, cowpeas, sunn-hemp and Sudan grass have survived the test, and proved themselves well suited for general growth under the local conditions.

It is noteworthy that in the rotation trials on the Red Soil Station the rotation in which the land received a green-manure crop ploughed under once in every four years has maintained the fertility of the soil (as evidenced by yields of maize) at as high a level as the rotation in which the land received a dressing of 7 to 8 tons of farm manure every four years, and benefited by a legume stubble and an oat stubble in addition.

A practically analogous result was demonstrated by the rotation trials on the Bulawayo Municipal Demonstration Station.

GWELO GAOL RECORDS.

	1923-24 Inches.	1924-25 Inches.	1925-26 Inches.	1926-27 Inches.	1927-28 Inches.	1928-29 Inches.	1929-30 Inches.	1930-31 Inches.	1931-32 Inches.	1932-33 Inches.
July	—	—	—	—	—	0.03	—	0.05	0.10	—
August	—	0.03	—	—	—	—	0.07	—	—	0.01
September	—	—	0.55	0.46	—	—	—	—	—	0.52
October	0.05	1.57	0.80	0.51	2.19	0.26	0.03	—	0.36	—
November	1.49	4.87	1.10	0.72	2.41	4.24	6.39	1.84	5.15	3.59
December	4.02	11.64	4.29	8.34	7.30	9.71	6.81	8.07	1.34	8.90
January	0.99	7.97	7.16	3.44	7.71	7.73	1.39	2.07	4.99	9.36
February...	1.50	11.50	5.61	5.12	0.88	6.13	1 66	7.02	2.39	2.30
March	3.56	5.55	0.02	2.17	1.01	5.95	1.63	0.80	10.07	0.83
April	—	3.26	—	0.79	0.31	—	3.31	1.67	1.14	0.50
May	—	0.82	—	—	—	0.02	0.06	0.23	0.10	—
June	—	—	—	—	—	—	—	—	—	—
TOTALS...	**11.61**	**47.21**	**19.53**	**21.55**	**21.81**	**34.07**	**21.35**	**21.70**	**25.64**	**26.01**

AVERAGE ANNUAL RAINFALL 25.05 inches.

SAND VELD STATION.

	1923-24 Inches.	1924-25 Inches.	1925-26 Inches.	1926-27 Inches.	1927-28 Inches.	1928-29 Inches.	1929-30 Inches.	1930-31 Inches.	1931-32 Inches.	1932-33 Inches.
July	—	—	—	—	—	—	—	—	0.02	—
August	—	—	—	—	—	—	—	—	—	—
September	—	—	—	0 72	—	—	—	—	—	—
October	—	—	—	0.08	2.35	0.16	—	—	0.25	—
November	—	—	—	0.69	4 32	3.20	5.95	1.66	5.69	2.67
December	—	—	—	7 65	4 98	8.38	6.43	11.14	1.58	10.51
January...	—	—	—	1.99	6.30	9.99	1.74	1.27	6.05	7.76
February...	—	—	—	5 13	0 48	6.39	2.49	6.46	3.22	2.25
March	—	—	—	2.44	0.74	5.42	1.81	0.55	7.28	1.72
April	—	—	—	0 58	0.47	—	4.79	0.80	1.25	0.40
May	—	—	—	—	—	—	—	—	—	—
June	—	—	—	—	—	—	0.18	—	—	—
TOTALS...	—	—	—	**19.28**	**19.64**	**33.54**	**23.39**	**21.88**	**25.35**	**25.31**

AVERAGE ANNUAL RAINFALL 24.05 inches.

RED SOIL AREA.

Crop Rotations.—The value of a rotation of crops in maintaining the fertility of the soil at a high level whilst at the same time maintaining the physical condition or tilth, has been demonstrated by two 4-course rotations.

In the first of these—Rotation Series A.—half the land was under maize grown for grain; a quarter under groundnuts, and a quarter under a leguminous green-manure crop. In the second rotation—Rotation Series B.—half the land was under maize grown for grain; a quarter under oats, and a quarter under a legume reaped for hay or grain.

In Rotation A. a green manure crop ploughed under once in four years has maintained the supply of organic matter in the soil, whilst in Rotation B. this has been done by a moderate dressing of farmyard manure (7-8 tons per acre) and the stubbles of the oat and legume crops.

In Rotation A. the land received a dressing of 200 lbs. per acre of bone and superphosphate every four years, and a dressing of 200 lbs. per acre of superphosphate every four years. In Rotation B. the land received 200 lbs. of superphophate once every four years.

The acre yields of the various crops in these rotations year by year are shown in the tables below, and also the average yields over the period of nine years. On an adjacent plot half the land has been cropped to maize continously and the other half has received a dressing of 150 lbs. of bone and superphosphate per acre every two years. This plot forms a check on the efficiency of the rotations in maintaining the fertility of the soil.

ROTATIONS.—RED SOIL AREA.

ROTATION : SERIES A.

Plots of ½ acre.

Yields of Maize in bags of 200 lbs. each. Yields of Ground Nuts in bags of 75 lbs. each.

CROP.	1932-33 Rainfall 25.31″	1931-32 Rainfall 25.64″	1930-31 Rainfall 21.70″	1929-30 Rainfall 23.39″	1928-29 Rainfall 34.07″	1927-28 Rainfall 19.64″	1926-27 Rainfall 19.28″	1925-26 Rainfall 19.53″	1924-25 Rainfall 47.21″	Average Yield per acre‡ for 9 years.	
†Legume Green Manure ... ... (ploughed under)	—	—	—	—	—	—	—	—	—	—	
**MAIZE: received 200 lbs. per acre bone and superphosphate — after legume green manure	**10.77	**12.64	9.81	7.20	21.10	9.20	13.00	21.00	14.50	13.24	12.08
*MAIZE: received no fertiliser after Maize receiving fertiliser	*9.03	*10.24	8.36	6.90	18.90	8.00	12.00	12.00	13.00	10.93	
††GROUND NUTS: received 200 lbs. per acre superphosphate after Maize receiving NO fertiliser	4.21	4.64	17.50	13.60	21.60	13.20	19.00	23.00	Sudan Grass	14.59	

**Received 250 lbs. p.a. Rock Phosphate 1931-32 and 1932-33. *Received 200 lbs. p.a. Bone and Superphosphate 1931-32 and 1932-33.
†Up to 1929-30 (inclusive) VELVET BEANS; 1930-31 onwards SUNN-HEMP.
‡Average for 8 years only in case of GROUND NUTS. ††From 1931-32 this crop received no fertiliser.

ROTATION.—SERIES B.

Plots ½ acre. Yields of Maize in bags of 200 lbs. per acre.

CROP.	1932-33 Rainfall 25.31″	1931-32 Rainfall 25.64″	1930-31 Rainfall 21.70″	1929-30 Rainfall 23.39″	1928-29 Rainfall 34.07″	1927-28 Rainfall 19.64″	1926-27 Rainfall 19.28″	1925-26 Rainfall 19.53″	1924-25 Rainfall 47.21″	Average Yield per acre. for 9 years.
*LEGUME: Reaped	*1.73	*2.96	*4.42	2.90	2.30	3 20	3.00	—	4.25	V.B. 3.13, D.B. 3.04 } 3.09 (8 yrs only)
MAIZE: received 200 lbs. superphosphate per acre after Legume reaped	10.29	10.87	11.20	5.90	21.20	9 90	9.00	10.00	9.50	11.11 } 12.67
MAIZE' received 7-8 tons farm manure per acre after Maize* fertiliser...	14 01	10 65	11.32	8.10	23.70	11 30	16 00	14.00	19.00	14.23 } 12.67
OATS: Var. KHERSON	Sudan Grass Reaped. Seed 236lbs.	Partial Failure. Reaped for Hay	Failed.	900 lbs.	604 lbs.	Fed Green	Fed Green	Fed Green	Fed Green	752lbs. (2 years)

*Commencing 1930-31 Dolichos Beans; previous to this Velvet Beans.

MAIZE CONTINUOUS.

A MAIZE: Continuous without treatment	3 80	5 50	5.20	4 20	13.10	4 40 fertiliser applied in error	4 00	6 00	9 00	6.13
B. MAIZE: Continuous received 159 lbs. p.a. bone and superphosphate every third year...	9.10 fert.	8.28	9.16 fert.	5.60	15.30 fert.	7.60	6.00	12.00	12.00 fert.	9.33

The above results are of great interest to farmers in the Midlands, and the following conclusions may be drawn from an examination of the tables:—

(1) The benefits of a rotation of crops, in which provision is made for the maintenance of the humus supply in the soil, compared with a system of continuous cropping, are amply demonstrated. It will be seen that the yield of the unmanured continuous maize plot has fallen to 3.80 bags per acre in the last year, and the average yield of all the land under maize in the two rotations is 11.02 bags per acre.

Further, the average yield of maize in both rotations for the period of nine years is 12.40 bags per acre, compared with an average yield of 6.13 bags per acre and 9.33 bags per acre, for the continuous maize without fertiliser and with fertiliser in alternate years, respectively.

(2) The average yield of maize in the two rotations over the nine-year period is practically the same, namely, 12.08 bags per acre for Rotation A. and 12.67 bags per acre for Rotation B. It would, therefore, appear that a legume green-manure crop with 400 lbs. of phosphatic fertiliser once in four years has proved as efficacious as a 7-8 ton dressing of farm manure with 200 lbs. per acre of phosphatic fertiliser once in four years in maintaining the humus content and general level of fertility of the soil. It should be noted also that in Rotation B. the maintenance of the humus supply has been further assisted by a legume stubble and an oat stubble, in addition to the farm manure.

It may be mentioned here that an almost exactly analogous result has been found in the rotations on the Bulawayo Municipal Demonstration Station over a period of ten years. It may also be noted that at the Gwelo Station the average annual rainfall for eight out of the ten years is 21.15 inches, and for seven out of the ten years' life of the Bulawayo Station the annual rainfall has been 15.37 inches.

(3) It will be seen from the yields in the 1928-29 season that in a season of exceptionally favourable rainfall the yields of crops on soil, which is becoming exhausted through continuous cropping to maize without fertiliser or manure, recover

in a marked manner. However, it is apparent that the crops on the plots under rotation have responded to the favourable season in a still more marked manner.

This is supported by the experience on the other experiment stations in the Colony, and illustrates one of the most important effects of the maintenance of the humus supply in the soil, namely, that it not only reduces the ill-effects of unfavourable seasons but it assists the crops to respond to favourable climatic conditions. In other words, it is the farmer's best form of insurance against the vagaries of climate. Nothing else will achieve the same result for him. Marked evidence of this is displayed by the results of the final season's cropping, for, despite the fact that during the crucial month of February there were 27 days without rain and only 2.25 inches fell during the month, and during March there were 29 days without rain and only 1.72 inches of rain fell, yet the average yield per acre of maize on the plots in the two rotations was 11.02 bags, whereas on the maize continuous plot the yield was 3.80 bags per acre. The maize receiving farm manure in Rotation A. gave the high yield of 14.01 bags per acre.

(4) A further advantage of the employment of a rotation of crops, designed to maintain the humus supply in the soil which, however, is not revealed in the tables printed above is, that the physical condition or tilth of the soil has been maintained on the rotation plots, but is deteriorating on the maize continuous plots owing to the depletion of the humus.

(5) Oats have not been a success in Rotation B. and it is considered that areas in the Midlands having a similar annual rainfall to that of this station are not suited to growth of the crop, owing to the climate being too dry. This crop has given consistently good yields on the Salisbury Experiment Station, where the average annual rainfall is appreciably higher. Sudan grass was substituted for oats in the last season, and despite the severe drought closing the season produced an excellent crop, and there is no doubt that this crop is well suited to conditions in the Midlands and Matabeleland. A mixture of oats and Sudan grass might be employed if desired, the latter crop then forming an insurance against failure due to drought.

(6) Ground nuts have proved themselves to be a rotation crop well suited to the local conditions and, provided a sufficient supply of phosphate and organic matter is available, can be depended upon to give consistently good yields.

(7) Sunn-hemp took the place of velvet beans in Rotation A. in 1930-31 and the succeeding year, and proved to be a more satisfactory green-manure crop than the latter, owing to its being unnecessary to cultivate the crop, and owing to its weed-smothering power amongst other additional qualities.

(8) Even in the driest seasons the legumes, dolichos beans and velvet beans, reaped for grain or hay in Rotation B., have given good yields. If planted dry before the arrival of the rains, both these legumes can be relied on to give good results for hay or grain, but in a wet season it is probable that dolichos beans will give a better yield, as the velvet beans are then liable to be badly affected with leaf spot disease.

MAIZE VARIETY TRIALS.

Commencing in 1924-25 a comparative trial of the four principal flat white dent varieties of maize grown in this Colony was carried out, and certain of the short-season varieties were also included in the trial.

It will be seen from the table of the results shown below that the four standard Rhodesian varieties far outyielded the others, and proved their suitability to local conditions.

These figures should not be taken to reflect truly the comparative cropping powers of the four Rhodesian varieties, as the experiments were not sufficiently replicated, nor carried on for a long enough period to give exact results:—

Name.	Average Yield in bags per acre.
Louisiana Hickory	13.25 (4 years)
Potchefstroom Pearl	13.00 (4 years)
Salisbury White	11.33 (3 years)
Hickory King	11.33 (3 years)
Iowa Silver Mine	7.50 (1 year)
American White Flint	6.00 (3 years)
Rhode Island White Cap	3 (2 years)
Krug Corn	½ (1 year)

RED SOIL STATION, GWELO

Fig 1. Plot No 7. In foreground, velvet beans to be reaped (after oats) In background, maize plot No 6 plus 200 lbs. superphosphate per acre (after velvet beans reaped).

Fig 2. Plot No. 9. Maize plus 8 tons kraal manure per acre (after maize).

GROUND NUTS.

This crop is admirably suited for growing under the soil and climatic conditions of the Midlands, and if given good treatment will give consistently heavy yields. It is particularly well suited to the sandy soils if these are well drained, since lifting of the crop is usually possible by hand-pulling and the shells of the nuts are not stained by the soil, and are thus as a rule suitable for export (after selection for size) without any added expense being incurred for sand-scouring or bleaching the shells.

The crop does best in a suitable rotation following a crop to which phosphatic fertiliser has been applied, though it may be necessary, if the best results are desired, to fertilise the crop direct. Whichever alternative is adopted, provision should be made for the maintenance of an ample supply of organic matter in the soil, either by the ploughing under of a green-manure crop once every three or four years, or by the use of farm manure.

If maximum yield without reference to the size of individual nuts is aimed at, a spacing of 18 in. x 6 in. to 9 in. will give the desired result, but hand-weeding will be necessary. If, however, machine cultivation is necessary, or if it is desired to obtain the highest percentage of large nuts suitable for the export market, then a somewhat wider spacing between the rows, of about 24 to 30 inches, may be desirable.

Varieties.—Both the Virginia Bunch and the Spanish Bunch varieties have given good results on this station, but when planted 3 to 4 weeks earlier than the Spanish Bunch, as it should be, the former has given a higher average yield by 6 bags per acre. The Virginia Bunch variety gives a higher yield per acre of crude protein and of hay than the Spanish Bunch, and for that reason should prove the more profitable if the crop is to be consumed on the farm. Both varieties are suitable for the export trade, when properly hand-selected.

Yields.—The average yield per acre of Ground nuts over the nine years in the Rotation A. on the red soil section is
sand veld section in the two rotations is 12.43 bags. The
14.59 bags of 75 lbs. each. The average yield per acre on the

highest yields recorded on the sand veld section have been 27.0 bags per acre in 1928-29 on a rainfall of 33.54 inches and 26.55 bags per acre in 1931-32 on a rainfall of 25.59 inches. On the red soil section the highest yield per acre has been 23.0 bags per acre in 1925-26 on a rainfall of 19.53 inches.

It should be mentioned that the sandy soil on the sand veld section is extremely badly drained and of poor inherent fertility, and for that reason on good sandy soils higher average yields than the average yield on the rotation plots recorded above may reasonably be expected, if proper treatment is accorded this crop.

GREEN MANURE CROPS.

Any of the legumes commonly grown in the Colony as hay or green-manuring crops are suitable for this purpose in the Midlands, but of these sunn-hemp has several qualities not possessed by the remainder which make it particularly valuable. The principal ones are (1) ability to smother weeds: (2) the fact that it requires no cultivation after sowing; (3) the seed may be sown broadcast on a maize stubble and covered with a disc-harrow, thus eliminating ploughing; and (4) it is practically entirely immune to attack from eelworms. The latter quality is of particular importance where a green-manure crop precedes potatoes or tobacco, and especially on irrigated fields.

On those farms which are severely infested with witch-weed, a host crop such as Sudan grass, white kaffir corn or early amber cane should be employed as a green-manure crop until the rate of infestation by the parasite has been reduced to a negligible level where it can be easily controlled by normal cultivation. The three crops mentioned can all be grown successfully in the Midlands, and experiments carried out at the Agricultural Experiment Station at Salisbury over the last five years indicate that two of such crops ploughed under in the one season, each of about six weeks' to two months' growth, have approximately the same green-manurial value as a normal green-manure crop of sunn-hemp or sunflowers.

If the seed of these crops is grown on the farm, as should be done, then the cost of growing them should not exceed the cost of green-manuring with sunn-hemp, with the exception of Sudan grass, which is a light seeder.

LEGUMES FOR HAY AND GRAIN.

Dolichos beans, velvet beans and cowpeas or kaffir beans have all proved themselves well suited for both hay and grain crops in the Midlands. On the red soils, however, the two former will usually give higher yields than the latter, but cowpeas are better suited to the sandy soils than dolichos or velvet beans.

Dolichos beans can be recommended for both purposes in preference to the white stingless velvet beans, but a new variety of velvet beans named the Somerset, which has been tested thoroughly at the Salisbury Station, promises to give better yields of both hay and grain than either. This variety has not been grown on the Gwelo Station, but there is little doubt that conditions in the Midlands will suit it just as well as the white stingless variety. However, very little seed of this variety is available at present.

Cowpeas or kaffir beans are better suited than any of the other legumes for sowing under maize for partial green-manuring, or for hay or grazing, but employed in this way they can only be depended on to give good results in seasons of good rainfall.

Dolichos and velvet beans may with advantage be sown in dry soil before the rains commence, but kaffir beans in the Midlands are best sown in moist soil, after the first rains have fallen. If sown after Christmas, as is usually the best practice in Mashonaland, they may not receive a sufficient rainfall for a full growth. All three crops have proved remarkably drought-resistant, and all three may be ensiled with success if mixed with a fair proportion of maize or other grass crop.

Soya beans have given promising results on the Station, but they cannot be recommended unreservedly, as they need a richer soil with a greater supply of humus than will suffice for the legumes mentioned above. Neither on this Station

nor at Salisbury have they given heavy enough yields of grain to make export an economic proposition, but the crop has one great advantage over the other hay legumes in that it is of upright growth and therefore cheaply and easily handled by hay-making machinery, whereas the other crops necessitate laborious and expensive cutting and manipulation by hand, when grown for hay. The specific bacteria of the Soya bean are not generally present in Rhodesian soils, and on soil which has not previously grown the crop the seed should be inoculated with a culture of the proper organisms. Experiments carried out on the Gwelo Station and elsewhere have definitely established the benefits of this practice, as shown in the table below. Cattle appear to relish Soya beans in the green state, whereas they normally refuse the other three legumes mentioned in the same condition.

The following table gives the average yields of seed of the principal legume crops grown on this Station:—

Crop.	Average yields in lbs. per acre.
Dolichos Beans	734 (5 years)
White Stingless Velvet Bean	661 (5 years)
Tracey's Early Velvet Bean	800 (1 year)
Osceola Velvet Bean	660 (1 year)
Soya Bean (O-too-tan var., Inoculated)	726 (3 years)
Do. do. not inoculated)	548 (4 years)
Sunn-hemp	411
Cowpeas or Kaffir Beans	525 (3 years)
Gram or Chick Pea	1,304 (1 year)
Canadian Wedge Pea	472 (1 year)

The Osceola and Tracey's Early varieties of velvet beans are not so suitable for hay, but give heavier yields of grain than the white stingless variety.

For those requiring a hard grain for finishing fat pigs, gram holds out considerable promise, but the yield recorded above must be considered abnormally high.

Canadian Wedge Pea for the same purpose has also shown promise. Under irrigation in the winter the wedge pea gives heavy yields of green forage or hay of high feeding value.

MISCELLANEOUS CROPS.

The following table gives the average grain yields per acre of various non-legume crops which have been grown on the Red Soil Section at various times:—

Crop.	Average yield per acre in bags or lbs.	
Sunflowers—		
Large Black Russian	7.20	(5 years)
Small Black Russian	7.00	(1 year)
Kaffir Corn	353 lbs.	(3 years)
Linseed (White flowering)	289 lbs.	(3 years)
Boer Manna	794 lbs.	(2 years)
Oats (Kherson)	752 lbs.	(3 years)

Sunflowers.—This crop has not given such high yields as to promise a profit when grown for export, but it is a useful stand-by on a mixed farm for helping to supply a variation in feed for livestock. It is an excellent rotation substitute for maize, and will give heavy yields for mixing in the silo with maize and other crops. It can, if necessary, be usefully employed as a green-manure crop, when it should be sown at the rate of 35 to 40 lbs. per acre (broadcasted).

Kaffir Corn.—Kaffir corn can not be depended on to give high yields of grain owing to the attacks of birds, stalk-borers and aphis, but should normally give much better yields than that recorded above. The chief uses of the crop in this Colony are for silage and witch-weed control. For this latter purpose some of the white varieties are very well suited, but the red-seeded varieties grown in the Colony have been found to be poor hosts of the parasite.

Linseed.—The climatic conditions in this Colony are not generally well suited for growing this crop *on a large scale* as a summer crop, but it is useful for the mixed farmer to have a small acreage planted as the linseed is useful for hand-

rearing calves and special treatment for stock. Small quantities of the seed can usually be sold locally at a price round 6d. per lb. It is a crop which exhausts the soil rapidly and should never be grown twice on the same land. Heavier yields are obtainable in the winter on irrigated land.

Boer Manna.—This is a useful annual hay crop, where the rainfall is normal, but in districts where long droughts may occur it is best substituted by or mixed with Sudan grass as an insurance against this. It is a host of witch-weed, but is not a very satisfactory trap-crop.

Oats.—The climate of the Midlands is hardly moist enough for reliable results to be expected with summer crops of this cereal, but in seasons of favourable rainfall, or as a winter crop under irrigation, good yields are obtained.

Sudan Grass.—As an annual grass-type hay crop this is probably the best crop which can be grown, as it will usually give two good cuttings and an aftermath. It is in addition an excellent trap-crop for witch-weed. The hay is palatable and nutritious, but like other sorghums it should be fed green with caution, especially after it has received a check in growth due to drought or other causes.

SAND VELD SECTION.

It is necessary, if the results obtained on this section are to be viewed in proper perspective, to realise that the soil on this Station is very inferior to the good sandy soils of the Midlands. It is very ill-drained, a number of large depressions exist on the plot and the soil is of a low inherent fertility. The average farmer would probably reject such a patch of soil on his farm.

Rotations.—If the above facts are borne in mind, it may be said that the results recorded in the tables of yields in the two four-course rotations which have been practised on this Station are, on the whole, satisfactory.

ROTATIONS—SAND VELD AREA.

ROTATION SERIES No. 1.

Plots $\frac{1}{2}$ acre each. Yields of Maize in bags of 200 lbs. each.

Crop.	1932-33 Rainfall 25.31″	1931-32 Rainfall 25.59″	1930-31 Rainfall 21.88″	1929-30 Rainfall 23.39″	1928-29 Rainfall 33.54″	1927-28 Rainfall 19.64″	1926-27 Rainfall 19.00″	Average yield per acre 6 years	
MAIZE: Received 200 lbs. p.a. Bone and Superphosphate—after Ground Nuts up to 1929-30	3 82	15 92	G.M.	3 60 K.M	4 60	6 50	15.00 K.M.	8.24	7.86
MAIZE: No treatment—following Maize receiving fertiliser	6.09 K.M.	13 13	G M.	4 00 K.M.	5.10	5 60 K M.	11.00 K.M.	7.48	
OATS: Following Maize	D.B. 296lbs.	— Failed.	G.M.	312 lbs K.M.	580 lbs.	— Failed	— Failed	446 lbs. (2 years only)	
GROUND NUTS: Received 6 tons farm manure per acre following Oats up to 1929-30	5 76	26.55	G.M.	10 50 K.M.	7.00 K.M.	10.80 K.M.	20.00 K.M.	13.32	

K.M. = Dressing of kraal manure at rate of 6 tons per acre.

G.M. = Green-manured with sunn-hemp which received 200 lbs. raw rock phosphate per acre.

D.B. = Dolichos beans reaped for seed. This crop was substituted for Oats, owing to failure of the Oat crop in three years out of five.

ROTATION SERIES No. 2.

Crop.	1932-33 Rainfall 25.31″	1931-32 Rainfall 25.59″	1930-31 Rainfall 21.88″	1929-30 Rainfall 23.39″	1928-29 Rainfall 33.54″	1927-28 Rainfall 19.64″	1926-27 Rainfall 19.00″	Average yield per acre 6 years	
MAIZE: No treatment, following Ground Nuts receiving fertiliser	5.01	11.51	G.M.	6.30	3.80	3.20	10.50	6.72	7.55
MAIZE: Received 6 tons kraal manure per acre, following Maize with no treatment ...	6.73	14.39	G.M.	4 00	4.80	6.90	13.50	8.38	
OATS (Kinvarra): No treatment, following Maize receiving kraal manure... ...	** —	Failed	G.M.	Failed.	372 lbs. K.M.	Failed.	Failed.	372 lbs. (1 year)	
*GROUND NUTS: Received 200 lbs. per acre of superphosphate	6.02	15.20	G.M.	15.20	7.60	9.30	16.00	11.55	

K.M. = Kraal manure dressing of 6 tons per acre.

G.M. = Green-manured with sunn-hemp which received 200 lbs. of raw rock phosphate.

*In 1931-32 the Ground Nut crop received no fertiliser, and in 1932-33 only 100 lbs. of Bone and Superphosphate.

**In 1932-33 sunn-hemp ploughed under substituted for Oats owing to frequent failure of latter crop.

Fig 3. Plot No. 14. Ground nuts plus 200 lbs superphosphate per acre (after maize).

Fig 4 Plot No. 7a Ground nuts (after oats plus kraal manure). Sand veld area.

In both rotations half the land has been under maize each year, one quarter under oats and one quarter under ground nuts.

In Rotation Series No. 1, owing to the excessively ill-drained condition and poverty of the soil, frequent dressings of kraal manure had to be resorted to in order to maintain the yields at something approaching a profitable level, and it is feared that the results obtained have little to teach us, except perhaps that on the sand veld the question of good drainage is of urgent importance.

In Rotation Series No. 2 the soil received a moderate dressing (6 tons per acre) of farm manure once in four years, a dressing of 200 lbs. per acre of superphosphate and a green-manuring once in six years. For such a poor, light sandy soil it can, therefore, be said that the manure and fertiliser treatment has not been generous. Nevertheless the yields of the maize and ground nuts, particularly the latter, have been well maintained. In this connection it should be remembered that the rainfall during the last season (1932-33) was very unfavourable, as it was excessive for ill-drained soil up to the end of January, from which time to the end of the season a virtual drought existed. Oats in both rotations have proved unsatisfactory, and cannot be recommended for general use on this type of soil, under the rainfall conditions obtaining during the period under review. A much more suitable annual grass hay crop is Sudan grass or, for young or well-bred stock (if high yields are not essential) teff grass.

As mentioned elsewhere ground nuts have proved themselves to be a crop pre-eminently suited to sandy soils, and this has been borne out by the results obtained in these rotations, which also emphasise that this crop requires an ample supply of humus in the soil.

The excellent yields of all crops in 1931-32 following the ploughing under of a crop of sunn-hemp in the previous year and particularly of ground nuts, which gave a yield of 26.55 bags per acre in Rotation Series No. 1, are worthy of remark.

From the results obtained in these rotation trials it would appear likely that a rotation in which one-third of the land is under green-manure each year is desirable or, alternatively, if the land can be dressed with farm manure once in four years, a four-course rotation in which the land is green-manured once in four years and dressed with 7-8 tons of farm manure also once in four years, would give economic results.

Whatever system is adopted it must include provision for ample maintenance of the humus supply in these light sandy soils, and ample supplies of phosphate fertiliser, with, possibly, small dressings of potash.

With a view to augmenting the humus supply in the soil partial green-manuring was attempted by under-sowing the maize with various legumes, as is mentioned below.

Undersowing Maize with Legumes.—In order to supplement the organic matter supplied in the two rotations in the form of kraal manure, up to 1929 trials of all the suitable legumes were carried out for undersowing the maize crop. The following crops were tested for this purpose:—Soya beans, dahl; velvet beans; gram; dolichos beans; white Jack beans; wedge peas and cowpeas. Of all these the only one to yield moderate results was the last-named, cowpeas; and in seasons when the rains stopped early these also failed.

These legumes were sown in the interspaces between the rows of maize in January at the time of the last cultivation.

It is possible that on the better sandy soils, or with more generous applications of fertiliser, undersown cowpeas would be successful in a majority of seasons, but the practice cannot be recommended unreservedly, and it is thought that a somewhat higher rainfall than normally occurs in the Midlands is necessary to make the practice consistently successful, owing to the extra drain on the soil moisture made by the undersown crop.

Undersowing cowpeas on the sandy soil of the Tobacco Experiment Station at Salisbury has been successful, where the rainfall is rather more plenteous and dependable.

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 14. January, 1934.

Red Locust (*Nomadacris septemfasciata*).—Egg-laying by a few belated swarms is still proceeding at the end of the month. It is difficult to account for the presence of these winged swarms at this late date, in view of the general earlier development of the great majority of these locusts. The belated swarms are not confined to any particular part of the country, and have been reported from the eastern to the western borders, that is from the most humid zone to a semi-arid zone. The latest report of egg-laying refers to the Melsetter district.

All these belated swarms show the yellowish breeding coloration and are not moving far.

Hatching of hoppers has continued throughout the month, every district in the Colony having now reported their presence. As anticipated, the main hatchings occurred during the first half of the month. Certain areas have experienced very heavy hatchings. In others the hopper outbreak has been lighter than anticipated.

In some places where egg-laying has been light, hoppers apparently of the "solitary phase" have been found. These are light green in colour, even as early as in the second stage, with a black dorsal stripe and other black markings showing very distinctly. The black band around the hind femur persists.

Damage to Crops.—In certain districts some loss of native crops from the hopper stage is reported. In individual cases European crops have been damaged, but such reports are exceptional and in general the farmers have been successful in defending their land from hoppers to date.

Maize, in certain districts has, however, suffered from the attack of the belated winged swarms, which appear to be feeding voraciously.

Isolated instances of serious attack by young hoppers on cowpeas and velvet beans have been reported.

Enemies.—Several reports have been received of good work against the hoppers by the White Bellied or Black Stork (*Abdimia abdimii*). In one case 100 acres of infested maize was reported as having been completely cleaned up by a large flock of these birds.

The White Stork (*Ciconia alba*) appears to have been little in evidence during the present season.

The Calliphorine fly, *Stomatorhina lunata*, having apparently increased in numbers in the earlier egg deposits, has been responsible for a moderate amount of destruction amongst the later deposits. Three generations of this fly have been reared in the laboratory, the whole life cycle from egg to adult occupying from two to three weeks at this time of year.

Widespread parasitisation of winged locusts with a *Red Mite* has been noted, but the attack is not heavy and probably of little or no economic importance.

Tropical Migratory Locust (*Locusta m. migratorioides*).—This species has not been in evidence anywhere, but one-fifth stage hopper was received at the Laboratories near the end of the month. Adults of this species are known to have entered into the Colony mingled with Red Locusts in November, and it is to be presumed that some eggs have been laid and a small number of hoppers hatched.

Campaign.—The campaign against the hoppers has proceeded steadily during the month, and very large quantities of poison are being consumed.

Whilst the declared policy of the Government is to defend crops and not to attempt the impossible task of extermination everywhere, the change is more or less nominal, and the campaign is, in practice, as general as in the past, the only areas not included being uninhabited and difficult of access. It has never been possible to operate effectively in such areas.

At the end of the month most districts report that the situation is well in hand, and in two the temporary locust staff has actually been reduced. The farmers generally are reported to be carrying out their part of the campaign satisfactorily.

There is every indication that the main maize crops of the Colony will be saved from the hopper stage.

The principal danger now anticipated is attack by early maturing swarms on late maturing maize, and every effort is, therefore, being made to ensure that hoppers do not mature (*i.e.*, obtain wings) in close proximity to the maize belt farms.

The fact that the winged locusts may attack tobacco and other crops is also not being lost sight of, and it is hoped that no considerable swarms will be allowed to mature in any of the agricultural areas of the Colony.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

DECEMBER, 1933.

AFRICAN COAST FEVER.

No cases occurred.

TRYPANOSOMIASIS.

Two cases occurred on the Eastern Border, Melsetter District.

ANTHRAX.

Five deaths occurred at the old infected area, Mtoko District, and all the incontact animals were inoculated. Another death occurred at a native kraal eight miles away and the incontact cattle will be inoculated.

SCAB.

Two outbreaks were dealt with in the Gwelo District.

TUBERCULOSIS.

Fifty-seven cattle were tested with Tuberculin on importation, no reactions.

MALLEIN TEST.

Nine horses and 22 mules were tested on importation with negative results.

IMPORTATIONS.

From the Union of South Africa: Bulls, 4; cows, 41; heifers, 15; calves, 15; horses, 3; mules, 22; sheep, 686; pigs, 100.

EXPORTATIONS.

Bulls, 14; horses, 6; sheep, 21.

To the United Kingdom *via* Union ports in cold storage: Chilled fore-quarters, 2,414; hind-quarters, 2,215; boned-quarters, 2,710; frozen quarters, 1,202; livers, 13,460 lbs.; tongues, 7,171 lbs.; hearts, 8,919 lbs.; skirts, 1,488 lbs.; shanks, 9,081 lbs.; tails, 5,276 lbs.; kidneys, 1,343 lbs.

G. C. HOOPER SHARPE,
Acting Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JANUARY, 1934.

Pressure.—Pressure for the month was above normal in the South and West and below normal in the North and East.

Temperature.—Mean temperatures were generally about normal.

Rainfall.—The rainfall for the month was disappointing and occurred mostly as thunder-showers and was patchy. The approximate total amounted to 5.3 inches compared with the normal 7.1 inches. The total from October 1st is 16.1 and the normal is 17 inches.

JANUARY, 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	101	64	89.7	69.1	79.4	77.2	78.2	70.8	70	67	...	3.66	5.8	13	...
Beit Bridge	961.6	...	102	64	89.7	70.1	79.9	...	78.5	70.6	67	67	6.0	2.62	2.9	7	1,510
Bindura...	889.4	...	91	60	82.5	64.4	73.5	...	71.2	65.5	74	63	5.9	5.50	7.5	18	3,709
Bulawayo	867.5	867.0	88	57	80.2	61.5	70.9	71.4	69.5	63.8	74	60	5.8	4.61	5.8	11	4,425
Chipinga	890.4	...	90	57	79.3	62.4	70.8	...	71.1	66.1	77	63	3.8	11.61	11.0	15	3,684
Enkeldoorn	856.1	...	89	55	79.8	59.5	69.6	70.2	69.3	63.2	72	60	4.2	4.39	7.1	11	4,787
Fort Victoria	893.5	893.2	93	57	83.2	63.3	73.2	72.3	72.9	65.8	69	62	3.6	2.60	6.5	7	3,570
Gwaai Siding	901.7	...	96	60	87.5	64.3	75.9	...	73.3	66.4	69	63	4.4	2.45	6.9	7	3,280
Gwanda	904.1	...	92	60	83.3	63.9	73.6	...	72.6	66.7	73	64	4.1	5.03	5.7	9	3,228
Gwelo	861.0	861.1	87	56	80.5	60.4	70.4	71.4	69.2	63.5	73	60	4.8	4.36	6.0	14	4,627
Hartley	884.7	...	89	56	83.4	61.8	72.6	73.3	70.9	65.5	75	63	3.4	6.55	8.1	15	3,878
Inyanga	834.8	...	81	49	74.7	56.9	65.8	...	67.3	60.5	67	56	3.9	6.49	9.5	16	5,513
Marandellas	836.5	...	84	54	76.9	58.2	67.5	...	67.0	61.2	71	57	6.2	4.75	8.6	11	5,450
Miami	877.0	...	89	58	80.2	62.3	71.3	...	70.5	65.3	75	62	5.8	6.65	9.1	12	4,077
Mount Darwin ...	905.3	...	91	57	83.9	64.9	74.4	..	73.5	67.4	73	64	5.9	4.22	8.5	13	3,178
Mount Nuza	800.2	...	72	48	65.3	52.9	59.1	...	58.4	56.4	89	55	6.3	12.97	...	16	6,666
Mtoko	875.4	...	91	57	83.6	63.0	73.3	...	71.9	65.1	69	61	3.6	2.52	8.1	7	4,140
New Year's Gift...	...	...	95	60	85.0	63.7	74.4	...	73.4	67.8	75	65	...	7.48	8.2	12	2,690
Nuanetsi	959.9	...	104	62	91.0	68.4	79.7	...	79.2	70.9	66	67	4.7	3.03	3.7	13	1,650
Plumtree	862.4	...	89	58	82.3	62.1	72.2	...	71.2	63.0	64	58	3.5	2.61	...	10	4,549
Que Que	880.0	...	91	58	83.2	62.3	72.7	..	70.9	65.4	75	62	4.7	5.03	6.9	15	3,998
Riverbank...	...	...	97	59	86.8	63.1	75.0	74.4	73.6	65.7	65	61	...	2.21	6.3	10	4,090
Rusape...	860.2	...	88	55	78.9	59.3	69.1	...	68.0	62.5	73	59	4.0	7.20	8.3	12	4,630
Salisbury	853.1	853.2	87	57	80.0	59.7	69.9	69.3	69.8	63.4	71	60	6.1	7.19	7.4	18	4,885
Shabani	905.3	...	97	61	84.8	65.7	75.3	...	73.7	66.9	69	63	6.3	3.68	6.6	12	3,192
Sinoia	886.2	...	92	56	83.8	62.7	73.3	...	72.5	65.9	71	62	4.3	7.62	7.6	18	3,793
Sipililo	883.1	...	89	57	80.6	62.7	71.6	...	72.4	65.3	69	61	4.6	7.33	9.0	14	3,875
Umtali...	891.0	891.3	92	59	82.0	63.3	72.6	71.9	72.4	66.2	72	63	4.6	9.59	8.3	11	3,670
Wankie	924.3	...	95	66	88.8	69.5	79.2	...	76.2	69.5	70	66	6.6	2.93	5.9	15	2,566

Rainfall in January, 1933, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
1	21	31	7	18	120	53	19	6	1	13	...	...	..	96	18	2	...	...	...	1	23	...	...	...	..	...	...	21	12	3	...	465
2	21	...	...	12	7	122	46	5	...	23	7	7	4	167	48	10	1	...	...	...	32	2	3	...	...	...	22	1	...	15	2	557
3	162	...	...	...	...	574	32	33	...	132	15	...	...	71	65	45	10	1	...	1	...	12	...	1	...	...	...	...	...	7	...	1161
4	17	7	35	77	47	122	51	14	2	33	1	4	2	111	25	17	...	...	..	1	...	...	1	...	...	...	2	18	57	...	...	644
5	39	5	22	6	6	24	15	4	27	1	12	..	16	55	...	22	...	...	...	...	50	...	...	...	...	...	9	25	7	13	...	358
6	3	...	...	51	36	32	103	10	14	37	...	19	3	19	47	73	3	...	...	2	...	...	...	...	..	...	...	79	10	...	...	541
7	14	2	...	...	11	233	49	9	5	25	15	13	14	40	19	73	43	4	...	...	...	1	1	...	...	...	21	2	17	...	3	614
8	7	...	...	8	26	51	8	3	4	37	43	16	9	63	67	41	70	13	1	2	...	...	...	...	2	1	9	91	59	18	...	649
9	...	11	...	27	19	20	9	52	10	15	151	1	23	1	26	42	80	91	...	...	...	...	...	...	...	2	45	37	13	15	...	690
10	...	...	...	...	7	20	15	1	...	62	110	..	2	42	2	4	2	61	...	...	...	...	...	...	...	...	2	4	3	...	...	337
Mean	19	10	8	19	37	80	30	13	8	21	33	5	9	72	24	27	19	17	—	1	18	1	1	—	—	—	14	23	15	8	1	533

Farming Calendar.

MARCH.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watchinig also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irriga-

tion, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until the latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles *at once*. Lift ground nuts that are sufficiently matured Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug

ENTOMOLOGICAL.

Maize—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1½ ozs., treacle ½ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbages and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Expert.

This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking cows and to allow the calves to get all the milk from now on Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

APRIL.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not

already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands; irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 or 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin

wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial control. The spray must hit the insect to kill. Do no re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growh may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Officers Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain A pamphlet on turkeys and turkey rearing is obtainable from the Poultry Officers.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producing first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

Departmental Bulletins.

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THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Report of Committee of Enquiry.—The Report of the Committee of Enquiry into the Economic Position of the Agricultural Industry of Southern Rhodesia was submitted to the Government early in March, and has now been published. The terms of reference were so comprehensive that the task of the Committee was a difficult one and the enquiry lasted for three months. Evidence was taken for twenty-two days in Salisbury and in addition all main centres of the Colony were visited. Two hundred and forty-five witnesses gave evidence and of this number one hundred and ninety-five were examined personally by the Committee. The report deals with every aspect of the agricultural industry and comprises forty-seven main headings and three hundred and forty-three sections.

The Committee is to be congratulated on completing a task of the greatest importance to the farming industry of this Colony, and the decision of the Government on the varied and numerous recommendations will be awaited with interest.

Copies of the Report of the Committee of Enquiry may be obtained from the Government Stationery Office, P.O. Box 75, Salisbury, and from the Civil Commissioner, Bulawayo, at a cost of 2/- per copy.

Visit of British Farmers.—A party of British farmers visited Salisbury from the 16th to the 18th of March. Arrangements for their entertainment were made by the Railways, The Agricultural Union, and the Department of Agriculture. The first day was occupied by visits to the Tobacco Warehouse, the Salisbury Experimental Station, the Veterinary Research Laboratories and to Mr. G. N. Fleming's farm, Gilston. The second day was spent in the Mazoe Valley. The first place of call was Messrs. Newmarch and McLean's estate, Glenara, where the two thousand six hundred acres under cultivation provided one of the surprises of the visit. The party then proceeded to the Mazoe Citrus Estate and was met at the Dam by Dr. W. J. Hall. After inspecting the Citrus Estate, where lunch was served, the party returned to Mr. Duncan Black's farm, Selby. After tea the visitors inspected Mr. Black's cattle, which provided another of the great surprises of the visit. In fact the farmers stated that they could easily take a place with the best in England. The party returned to Salisbury at 6 p.m., and in the evening were the guests at a Municipal banquet at Meikle's Hotel. On Sunday afternoon His Excellency the Governor and Lady Rodwell were "At Home" to the Party at Government House, and the Party left Salisbury at 8 p.m. for Gatooma.

Weeping Willow Leaves as Cattle Feed.—We are indebted to Capt. J. M. Moubray, of Chipoli, Shamva, for calling our attention to the possibility of using the foliage of the Weeping Willow as a supplementary feed for cattle, particularly during times of drought. He points out that a row of these trees along a stream or round a dam would be a most valuable source of

cattle feed in times of scarcity. The foliage can be lopped off when required; if not wanted this year it can accumulate until it is needed. These trees thrive on being cut back.

Capt. Moubray submitted a quantity of the leaves to the Chief Chemist for analysis and the result which is given below indicates that they possess all the qualities of an excellent cattle feed. The analysis is as follows:—

Moisture	13.9%
Ash	8.8%
Crude Protein	14.4%
Ether Extract	2.5%
Crude Fibre	15.5%
Carbohydrates (by difference)	44.9%
Nutritive Ratio	1-4.6

Tsetse Fly and Game.—A good deal of interest has been aroused recently by statements in the press, and by circulars which have been widely distributed, in the relationship which exists between tsetse flies and game. Owing, it is believed, to a lack of the necessary information, the policy of the Government of this Colony in regard to the reduction of game on the edge of the fly-area has been severely criticised. We therefore suggest that the article by the Chief Entomologist which appears elsewhere in this issue will be read with interest by all our readers.

Root Gallworm.—It will be of particular interest to tobacco growers to note that in a recent memorandum issued by the Imperial Bureau of Agricultural Parasitology it is suggested that the strain of nematode concerned in producing potato gallworm is incapable of attacking other plants. This memorandum provides a useful summary of the present knowledge relating to potato eelworm and soils which are infested with this pest. The destruction of the eelworm by means of chemicals applied to the soil is regarded as offering little prospect of success and attention is now being devoted to the effect of the excretions from the roots of different plants upon the hatching of the eelworm eggs. It will be recalled that

these eggs, in the "cyst" formed by the skin of the parent eelworm, are able to lie dormant in the soil for long periods; when potatoes are planted, however, the eggs are influenced in some way by the potato roots and hatch into young eelworms. As the potato root eelworm appears to belong to a strain capable of living only upon the potato, it is clear that if the eggs can be stimulated to hatch in soil in which no potatoes are growing the young eelworms will starve to death. Mustard was found to be one of the plants which contained in its roots a substance capable of causing the eggs to hatch, but the influence of growing mustard was not found to give the results hoped for. Apparently a grass, of some kind not stated, is considered to offer distinctly better chances of success and further developments will be awaited with interest.

Pyrethrum for Farm Use.—In Kenya, where pyrethrum is grown for use on the farm, pyrethrum insecticides are widely employed, the extract often being home-made. The method recommended by the Agricultural Department of Kenya is to have a series of drums, each with a hole bored into the bottom and so placed that one drum runs into the top of the next. A plug of cotton wool is placed in each hole to act as a filter. Pyrethrum powder is placed in the drums and kerosene at the rate of 1 gallon to each 1 lb. of powder is allowed to percolate through, extracting the pyrethrins in passing. This mixture in Kenya is atomized directly on to the coffee trees for the control of the Coffee Bug, but there seems no reason why it should not be just as effective if used as an emulsion in water.

Environment and Plant Life.—One of the outstanding developments in Agriculture during the past few years has been the study of plants in relation to their environment from new angles. The old definition of the word environment—"the conditions influencing development or growth"—apply precisely to these recent studies, and the results of the investigations have necessitated the coining of several new words. Perhaps the best-known of these are "photoperiodism" and "vernalization." In order to appreciate what these words imply some explanation may be necessary.

Green plants owe their characteristic colour to the chlorophyll they contain. With the aid of this substance, the leaves and other green parts of plants, by utilising sunlight, are able to elaborate starch, sugar and other organic substances from the minute quantity of carbon dioxide contained in the air. It is hardly impossible to over-estimate the importance of this process, for without it all forms of life would cease to exist.

During the countless generations which have gone before, plants have definitely accustomed themselves to the light and climatic conditions under which they normally grow, and the length of day is one of the most important factors to which plants have to become accustomed. During night-time, the elaboration of carbo-hydrates continues, and under normal conditions there is a definite balance between the day and night functions of the plant which regulates not only the growth of the plant but also its reproductive function. Recent investigations have shown that the majority of plants fall readily into one or three groups

(*a*) long-day plants;
(*b*) short-day plants, and
(*c*) plants apparently indifferent to the length of day.

The word "photoperiodism" is, therefore, a term applied to the length of day requirements which are found to be normally necessary for the optimum growth conditions of a plant. The importance of this discovery is best illustrated by attempting to introduce a crop which normally grows under different conditions from those which prevail in the country in which it is proposed to grow it. We are all well acquainted with the statement that in regard to such crops it is necessary to import fresh seed every third of fourth season, otherwise the crop deteriorates. The results of recent experiments would indicate, however, that this is not the correct interpretation, but that an attempt should be made to secure a strain which is indifferent to, or has definitely adapted itself to the new conditions. It is obvious that this could not be anticipated in one or two seasons, but would probably require a number of years before it was sufficiently acclimatised to enable suitable strains to be selected.

It has been found that in addition to the requirements of a definite length of day climatic conditions also play a most important part, and it has been found possible, by applying artificial conditions during part of the life of a plant, to affect the ultimate growth in a most remarkable manner. The most important work in regard to this question was carried out at the Odessa Plant Breeding Station by Lyssenko in 1931, and it was from these experiments that the word "vernalization" arose. In this case the original experiments aimed at shortening the time necessary for the plant to pass through all the stages of its life-cycle to produce flowers and seed. It was found that if the necessary adjusting conditions were applied during the young seedling stage, while the plant is living on the food stored in the seed, the plants obtained from such seed could then be grown under the new conditions exactly as if the conditions applied to the germinating seed were being continued. The process of vernalization is therefore the pre-treatment of seed to expose it to the conditions necessary for transition to the reproductive stage.

In the case of tropical and sub-tropical plants, where short days are necessary for normal seed-production to take place, it was found that by subjecting germinating seed to suitable conditions of humidity, temperature, aeration and darkness, such seed would then produce plants which would flower and set fruit even when grown under conditions of continuous illumination. It should be realised, therefore, that the process of vernalization may have a most important bearing on the future production of crops, and that this process, coupled with suitably controlled growing conditions, may make it possible to grow any variety of plant under what would have appeared previously to be abnormal conditions.

Cowpea Hay in the Ration for Bacon Pigs.

By C. A. Murray, M.Sc. (Agr.), Lecturer in Animal Husbandry, Matopo School of Agriculture and Experiment Station.

As a green manure crop and/or cattle feed legumes are grown on a fairly large scale in Southern Rhodesia, but up to the present very little use has been made of the hay in rations for young growing pigs.

Although excellent results have been obtained in the U.S.A. from the feeding of legume hays, particularly lucerne hay, to brood sows and, to a lesser degree, to growing pigs, no local work has been done in this connection.

The experiment reported on here is the first of a series planned to investigate the feeding qualities of different legume hays in the rations for young growing pigs, and this experiment deals specifically with hay obtained from the New Era variety of Cowpea (Vigna Catjang).

Review of Literature.—The literature on the subject is extensive and scattered. However, the investigations referred to (Fargo and Bohstedt 1929, Henry and Morrison 1930, and others), have shown that legume hay is not only rich in protein of a quality which supplements the cereal proteins very well, but that it is also rich in calcium, is slightly laxative and, if properly cured, is high in vitamin A. Unfortunately, due to the unsuitability of the digestive tract of the pig for the utilisation of large quantities of roughage, it was found inadvisable to include more than 5 per cent. of legume hay in the rations for young growing pigs.

PLAN OF EXPERIMENT.

The experiment was carried out at the Matopo School of Agriculture during the period 1st August, 1933, to 5th November, 1933.

Experimental Pigs.—Two similar groups of ten pigs per group of Tamworth X Large Black cross-bred weaners were used.

Rations Fed.—The following rations were fed to the two groups of pigs (proportions by weight).

Group 1.—90 maize meal.
10 meat meal.
1 salt.

Group 2.—87 maize meal.
9 meat meal.
4 cowpea hay (17.9% Cr. Protein).
1 salt.

Both groups of pigs were kept in styes and fed concentrates in the form of a thick slop and were given as much as they would clean up twice daily in about 20 minutes.

The pigs always had free access to clean drinking water and received small amounts of green feed daily.

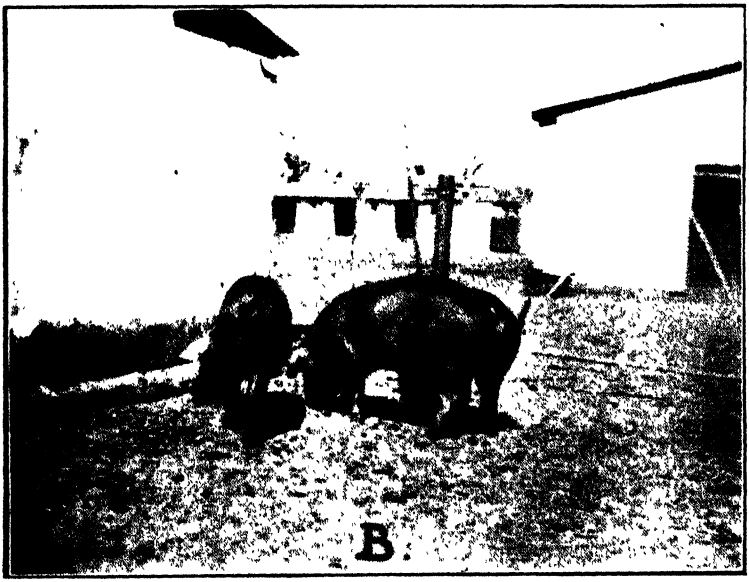
Throughout the experiment the pigs were weighed regularly at fortnightly intervals and as they reached market weights and finish they were railed to and slaughtered at the abattoirs of the Rhodesian Export and Cold Storage Co., Ltd., Bulawayo.

After slaughtering and dressing, the carcasses were graded, the necessary observations and measurements taken, and fat samples obtained for refractive index determinations.

EXPERIMENTAL RESULTS.

Growth of Pigs.—In Table I. data concerning the growth and feed consumption of the two groups of pigs are given:—

Group I Baconers



Group II Baconers

Table I.

		Group I.	Group II.
No. of Pigs per group		10	10
Average initial weight	lbs.	89.4	90.7
,, marketing weight	lbs.	196.5	194.8
,, initial age	days	103.4	104.7
,, age at marketing	days	183.4	189.5
,, gain daily	lbs.	1.33	1.23
,, daily consumption of concentrates per pig	lbs.	4.7	4.5
Concentrates per 100 lbs. gain in live weight	lbs.	352.0	365.0

Throughout the experiment both groups of pigs grew well and had a sleek, thrifty appearance. The average daily gains for Groups I. and II. were 1.33 lbs. and 1.23 lbs. respectively.

The difference in rate of gain between the two groups was small and not significant (Difference and Standard Error of Difference: .10+.08) and can probably be accounted for by the fact that the average daily feed consumption of the Group I. pigs was slightly higher than that of the Group II. pigs.

Both groups of pigs also made equally uniform gains—the co-efficients of variation of the average daily gains of Groups I. and II. being 12.6% and 13.5% respectively.

On the average Groups I. and II. reached market weights and finish at 184 and 190 days respectively, and a few pigs in each group matured at the early age of 5 months and 1 week. The average marketing weights were 197 lbs. for Group I., and 195 lbs. for Group II. These weights, according to Murray (1927-1930), fall within the most desirable weight class (190 to 200 lbs.) for marketing Tamworth X Large Black baconers from the point of view of producing the highest percentage of "Prime" carcases.

The average daily feed consumption per pig was satisfactory and was .2 lbs. higher for Group I. than for Group II. As regards the amounts of feed required to produce 100 lbs. of gain in liveweight there was very little difference between the two groups.

Suitability of the Carcases for Bacon Production.—In Table II. the different carcase measurements and the grading of the carcases are given.

Table II.

		Group I.	Group II.
Average length of side	ins.	30.0	30.0
,, depth of side at shoulder	ins.	17.0	17.0
,, depth of side at flank ...	ins.	16.2	16.0
,, thickness of backfat at:			
Nape	ins.	1.10	1.08
Shoulder	ins.	2.14	2.12
Back	ins.	1.47	1.46
Loin	ins.	1.76	1.75
Average	ins.	1.62	1.60
Variation in thickness of backfat	%	20.	21.0
Refractive Index of fat at 40 degrees C.	%	1.4594	1.4594
Grading of carcases:			
Prime	%	80	80
Medium	%	20	20
Stout	%	—	—
Inferior	%	—	—
Carcases faulted on account of:			
(1) Poor hams...	%	—	—
(2) Bad proportion of lean to fat	%	—	—
(3) Bad proportion of fat to lean	%	—	—
(4) Heavy shoulders	%	—	—
(5) Thin bellies	%	—	—

A study of Table II. shows that, as regards length and depth of carcase, there was no difference between the two groups of pigs.

Although on the average the Group I. carcases had slightly thicket backfat than the Group II. carcases, at all points where the fat measurements were taken the differences were very small (Nape .02 ins., Shoulder .02 ins., Back .01 ins., Loin .01 ins.) and not significant.

As regards the uniformity of the backfat it is necessary to have a factor expressing the amount of variation in the thickness of the backfat of any one more carcases, *i.e.*, an index of the uniformity or evenness of the backfat. For this purpose the average deviation from the mean is suggested. It is obtained by finding the average thickness of the backfat and adding the differences between this measurement and the individual backfat measurements irrespective of whether the difference is a plus or a minus. This figure is then expressed as a percentage of the sum of the four backfat measurements. Expressed in this way the average variation in the thickness of the backfat was 20% and 21% for Groups I. and II. respectively. There was, therefore, no difference in the evenness or uniformity of the backfat of the two groups of pigs.

As regards firmness of the fat as shown by the average refractive index at 40 degrees C. there was no difference between the two groups.

The carcases were graded according to the standards of Duckham (1929). He points out that according to the requirements of the British market " 'Prime' carcases are easily marketed, whereas the market for 'Medium' bacon is more limited. ' Inferior ' and ' Stout ' carcases are definitely unsuitable and are not wanted." Table II. shows that 80% of the carcases in both groups graded "Prime" and 20% "Medium." There were no carcases in the "Stout" or "Inferior" grades. These figures, together with the fact that none of the carcases were faulted on account of poor hams, thin bellies, etc., should be considered very satisfactory, and confirms the results of previous investigations by Murray (1927-1930) as regards the suitability of the Tamworth X Large Black cross for the production of "Prime" quality bacon.

SUMMARY.

Results are reported of an experiment carried out at the Matopo School of Agriculture to investigate the feeding qualities of cowpea hay in the ration for bacon pigs.

Both from the point of view of the growth of the pigs and of the effect of the feed on the type and quality of the carcase, the two rations proved equally efficient.

Four per cent. of cowpea hay successfully replaced one per cent. of meat meal in the ration for bacon pigs.

The Tamworth X Large Black cross produces an early maturing, thrifty baconer of good length and quality and very suitable for the production of "Prime" quality bacon. The progeny are all black and the cross should, therefore, be very suitable for areas where white pigs suffer from sun-scald.

ACKNOWLEDGEMENTS.

I am indebted to Dr. D. G. Haylett, Director of the Matopo School of Agriculture, for providing the necessary facilities for carrying out the experiment and for assistance with the preparation of this report; to Dr. A. E. Romyn, Senior Animal Husbandry Officer, for assistance and suggestions throughout the experiment, and to Mr. R. H. Greaves, Stockman, for regularly weighing the pigs and supervising the feeding.

Grateful acknowledgements is also due to the Manager and staff of the Rhodesian Export and Cold Storage Co. for their co-operation and assistance and for providing the necessary slaughtering and inspection facilities.

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Suggestions for Expediting the Drying of Maize.

By S. D. Timson, M.C., Dip. Agric. (Wye),
Assistant Agriculturist.

The following suggestions for hastening the natural drying of maize are put forward by request, for the benefit of those farmers who wish to avail themselves of the premium offered by the Maize Control Board on maize delivered in April, and up to the 20th May.

Such maize may contain up to 15 per cent. of moisture, and it is understood that an appreciably higher percentage of broken grain will be allowed than is normally permitted in grain intended for export, provided the grain is sound.

It is well-known that if maize is reaped before it is ripe, a loss in yield will take place, and to assist farmers to decide the earliest stage at which it will pay them to commence reaping, it may be mentioned that extensive experiments in the U.S.A. have shown that a crop of maize which yielded fourteen bags per acre when cut in the dough state, when cutting was postponed to the ripe stage, yielded twenty bags per acre. Therefore, cutting in the dough stage caused a loss of 30 per cent. in the yield of grain.

Grain can normally be considered ripe when the grain is well dented, withstands considerable pressure from the thumb nail, and the leaves are beginning to dry off.

From the above facts the farmer can decide how early it will pay him to reap with the premium as mentioned above.

(1) **Methods of Drying.**—Having reaped the maize, the most rapid method of drying is undoubtedly by using a flue-curing tobacco barn. The cobs should be husked, and may be either tied in bundles and hung over the tobacco sticks, or an alternative method, described below, which would allow of a greater weight of cobs being dried at one filling, may be employed.

The cobs may also be laid out side by side and as close together as possible, *in a single layer*, on shelves made by placing tobacco sticks side by side with a space of about three inches between them. The extra sticks are placed in the same way as when they are used for hanging tobacco, but of course, many more will be needed.

A shelf will occupy each tier of the barn, and the top shelf will, of course, be covered with cobs first, and so on, down to the bottom shelf.

When the barn is full the ventilators should be closed, the fires started, and the heat run up to about 160° F. After this temperature is reached some ventilation must be given to allow the moisture driven off to escape and fresh air to enter.

It cannot be stated what length of time will be required to dry the grain to a moisture content of 15 per cent., but it is thought that a period of eight to twelve hours will suffice, judging by the experience of one gentleman, who has used this method in the past.

One barn 16 ft. by 16 ft., with seven tiers of cobs, it is estimated, should contain sufficient cobs to yield approximately twenty to twenty-five bags of grain; with five tiers fifteen to twenty bags of grain should be dried at a filling. If, therefore, it is possible to dry two fillings in twenty-four hours, such a barn would be able to turn out the equivalent of thirty to forty bags, or forty to fifty bags of dried shelled grain in a day.

It is considered that a full barn (seven tiers) of cobs would weigh approximately up to 6,000 pounds to 7,000 pounds, and a well built barn in good condition should support this weight without danger of collapse.

Of the additional methods of drying maize, most of them need merely be mentioned, but in all cases, the cobs must be husked as *the husks very greatly retard the rate of drying.*

(2) The cobs with the husks turned back, but not torn from the cobs, may be tied to poles, or ropes, in trees or on other supports, as is done by the natives and by the coloured people in the Union.

(3) The husked cobs may be laid on corrugated iron, or the roofs of buildings, on bare beaten earth drying-floors, or on natural rock floors, which are available on some farms.

(4) If white ants are not troublesome, the husked cobs may be dried on the ground in the fields, being left in a layer of *not more than* 1 *cob deep.* Attention may here be drawn to an experiment carried out by the Department of Agriculture, which was reported in the July, 1926, issue of the *Rhodesia Agricultural Journal.* In this experiment it was found that maize on the cob, when the husks were removed and cobs left to lie in the field on the bare ground, dried out from a moisture content of 28.0 per cent. to 15.8 per cent. between 17th May and 26th May, that is, in ten days.

Maize reaped in April may contain an appreciably greater amount, up to possibly 35 per cent. of moisture, or even more, and would therefore take longer to dry out to the same extent; probably about fourteen days.

(5) Where ants are present, but are not excessively troublesome, the maize cobs may be laid to dry on maize stalks on the ground, after the husks are removed.

(6) A method which, it is thought, would ensure as little loss in yield as possible, is to pull back the husks on the cobs, exposing the latter to the wind and sun, without breaking them from the stalks of the maize plants, thus leaving them to complete their maturity on the standing stalks in the field. This method would allow the grain to continue to receive a further food supply from the leaves, but should hasten ripening and drying out appreciably. When the grain has become ripe, the cobs should be reaped from the stalks and treated further by one of the methods suggested above.

The Life History of the Screw-Worm Fly.*

By ALEXANDER CUTHBERTSON, *Entomologist.*

The biology of the Screw-worm Fly (*Chrysomyia bezziana*) was studied at Glass Block Ranch, near Balla-Balla in 1931. Some notes were published in the *Proceedings of the Rhodesia Scientific Association*, Vol. XXXII., pp. 95-99 (1933).

The adult flies (females, Pl. I., fig. I.) are found on fresh bleeding wounds of cattle, their food being blood and serous exudations. Males feed on the nectar of flowers of shrubs, *e.g.*, Gymnosporia, ("*Sihlangu*" of the Matabele), and on the sweet "honey dew" secretions on the flower-heads of grasses (Paspalum) infected with Ergot. Newly-emerged flies of both sexes were observed frequently feeding on surface liquids of fresh cattle-dung in kraals. No Screw-worm Flies were seen at carcases which attracted large numbers of blow-flies (*C. marginalis*, *C. albiceps*, etc.). Purulent or suppurating wounds, also, do not attract *bezziana*.

The Screw-worm Fly can be distinguished from the common blow-flies by the uniform greenish-blue metallic colour of the body, the orange-yellow face, and the absence of a blackish front-margin on the wings.

The following blow-flies may be mistaken for the Screw-worm Fly, but differ in colour and markings, as mentioned below:—

1. *Red-headed Blow-fly* (*C. marginalis*).—Eyes and face conspicuously reddish-yellow; wings with a narrow black border on the front margin.

2. *Green Banded Blow-fly* (*C. albiceps*). Pl. III., fig. I. Body bright clear green; face white.

*The treatment of myiasis and control measures were discussed in the February, 1934, number of this journal (pp. 100-111).

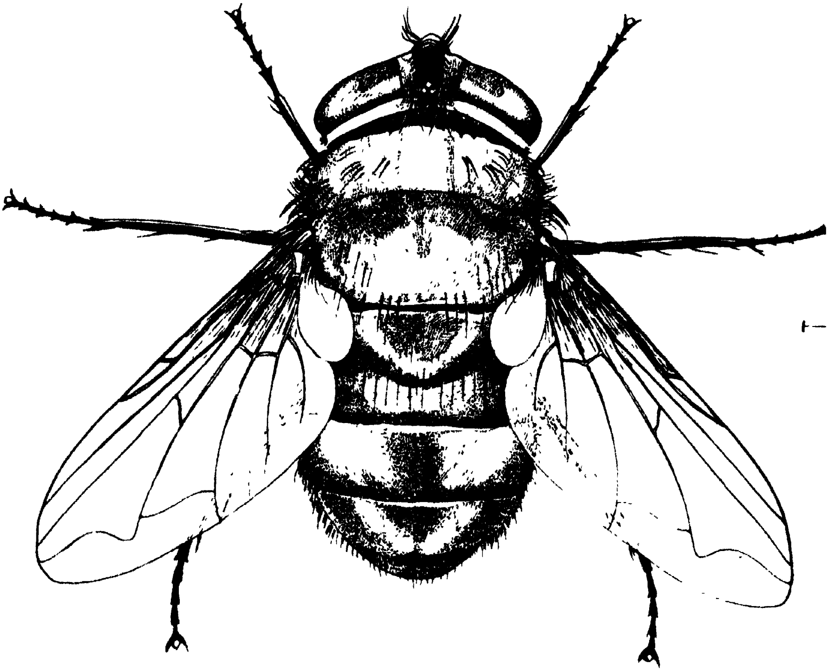


Plate I
Fig 1. C bezziana

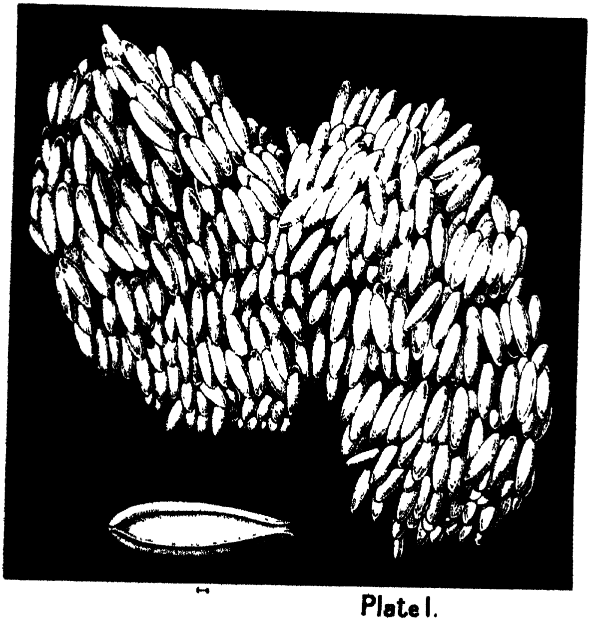
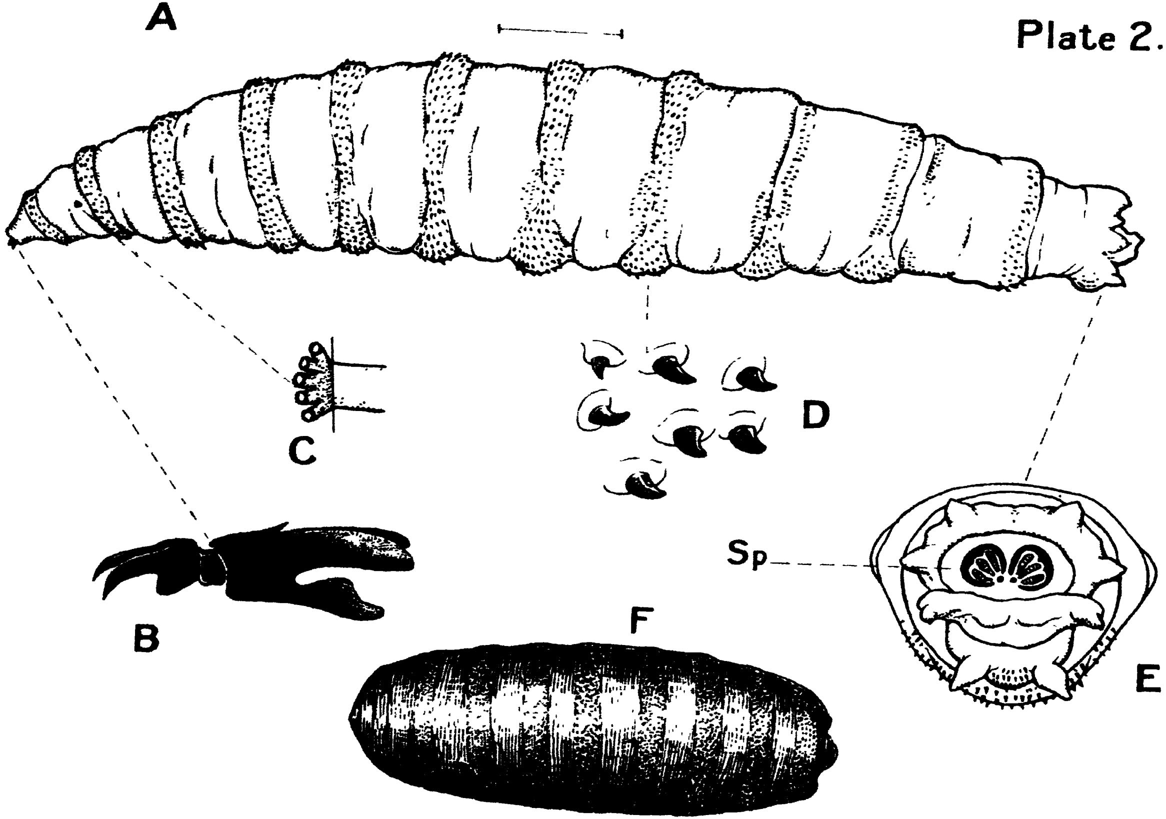


Plate I.

Plate 2.



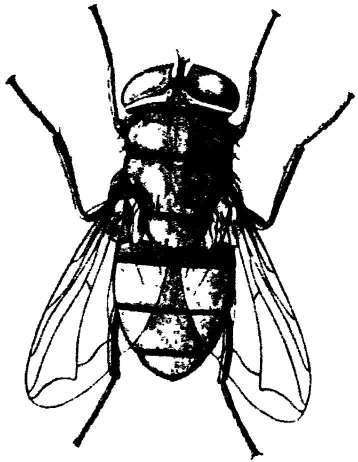


Fig II

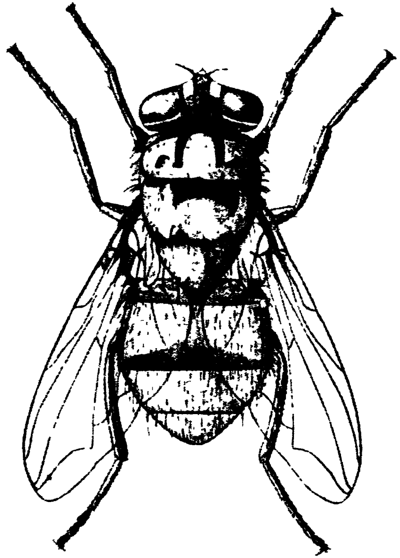


Plate III, fig I

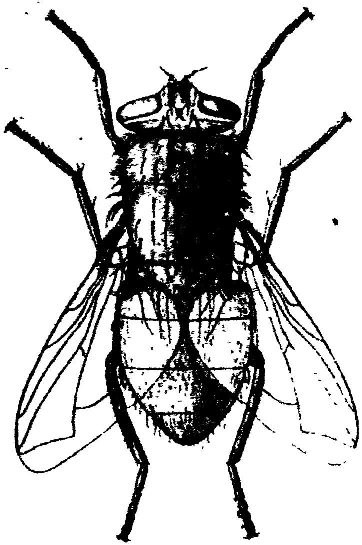


Plate IV . fig I

Plate IV . fig II

3. *Green-tail Blow-fly* (*C. chloropyga*). Pl. III., fig. II. —Front part of thorax with a blackish L-shaped mark on the right side, and a reversed L on the left side; two hind segments of the abdomen are shining brassy-green.

4. *Sheep Blow-flies* (*Lucilia spp.*).—Slender, bristly "green-bottles." Pl: IV., fig. I.

The life-history is as follows:—The eggs are laid in one or more batches (Pl. I., fig. 2) inside the rim of wounds, sometimes on the unbroken skin covering bruises and abscesses, and occasionally on places soiled by septic exudations and blood from wounds.* The eggs are securely glued together, and the batch is attached to the skin of the animal by means of a sticky secretion. They hatch in about 18-24 hours. The newly-hatched larvæ or maggots feed on liquids exuding from the interior of the wound for about a day, later becoming embedded in the living flesh. Their strong mouth-hooks (Pl. II., fig. B) and the bands of backward directed spines (Pl. II., fig. B) are excellently suited to this parasitic mode of life. When immersed in the flesh they breath by means of two "*breathing-pores*" or spiracles on the hind-end of the body (Pl. II., fig. E, sp). In about six days from the time of hatching the maggots are fully fed. They then leave the wound and drop to the ground where they bury themselves about an inch beneath the surface of the soil. In a day or two they shrink in size, and the outer skin hardens becoming reddish-brown in colour, presenting a barrel-shaped appearance (*puparium*) (Pl. II., fig. F). This stage, the pupal stage, lasts from 7-9 days in the hot weather of the wet season, but is much longer in the cold weather of the dry season (July-August). When fully developed the flies creep from the *puparium*, and force their way upwards to the surface of the soil. Emergence usually takes place in the early mornings.

The potential rate of increase of the fly is tremendous. There are probably at least eight generations in the year, and a female fly is capable of laying up to 500 or 600 eggs. No

*The Screw-worm Fly does not breed in carrion. The American Screw-worm Fly (*C. americana*) has been in the past confused with the common Blow-fly (*C. macellaria*), but is purely a parasitic species (Cushing & Patton, 1933).

parasites of the early stages are known. Certain small ants (*e.g.*, *Pheidole punctulata*) occasionally seize fully grown screw-worms as the latter are about to enter the soil to pupate. In view of these facts, it is of the greatest importance that all screw-worms taken from wounds should be effectively disposed of, either by scraping them into a tin containing a little paraffin and water, or by burning them. If this is not carried out thoroughly, the neighbourhood of kraals where cases are treated is likely to become a dangerous centre of infestation.

Acknowledgements.—I am indebted to the Government Lithographic Superintendent for the drawings, illustrated on Plates I. and II., which have been made from specimens and rough diagrams supplied to him. I have also to thank the Rhodesia Scientific Association for the loan of blocks used to illustrate Plates III. and IV.

EXPLANATION OF PLATES.

Plate I., fig. I.—Female Screw-worm Fly (enlarged).

Plate I., fig. II.—Batch of Eggs, and a single Egg (highly magnified).

Plate II., fig. A.—Screw-worm (enlarged); fig. B, mouth-parts showing powerful mouth-hooks (highly magnified); fig. C, minute "*breathing-pore*" or spiracle néar head-end of Screw-worm (highly magnified); fig. D, backwardly directed spines on body (highly magnified); fig. E, hind-end of Screw-worm showing two "*breathing-pores*" (sp); fig. F, Puparium (enlarged).

Note.—The natural size of fly, egg, screw-worm, and puparium is indicated by a short black line at the side of each drawing.

Plate III.—Flies mistaken for the Screw-worm Fly. Fig. I., Green-tail Blow-fly; fig. II., Banded Blow-fly. (All after B. Smit.)

Plate IV.—Fig. I., Sheep Blow-fly; fig. II., yearling heifer with large wound infested with screw-worms deep in the tissues, and with Lucilia (Sheep Blow-fly) maggots at the surface.

TSETSE FLY AND GAME.

By R. W. Jack, Chief Entomologist.

The following article is intended to explain in popular language the scientific basis on which the present Government operations against tsetse fly in Southern Rhodesia depend.

The subject matter is confined to consideration of the question of the dependence of our common tsetse fly, *Glossina morsitans*, Westw. on game and the feasibility of controlling the fly by judicious reduction of game in selected areas. Alternative measures for control of tsetse fly are not discussed. Even with this limited scope the article is of considerable length, as an attempt has been made to deal with various aspects of the problem in a reasonably comprehensive manner.

It should be stated in advance that there exist in Africa some twenty different species of tsetse flies, which have different habits and requirements, and that what applies to one species does not necessarily apply to another. The common species in Southern Rhodesia is *Glossina morsitans*, and this is the only species with which we are concerned in the northern districts of the Colony. Unless otherwise indicated the terms "tsetse fly" and "fly" throughout this article refer to *G. morsitans*. *G. morsitans* is one of the species which are specially associated with game. Some other species are known to feed largely on reptiles, and it has never been suggested that removal of game would eliminate such species.

Historical.—Before proceeding to deal with modern opinion on this subject, it will be of interest to say a few words concerning the origin of the idea that the fly is dependent on game. It is a common mistake to attribute the origin of this belief to the well known sequel to the Rinderpest epizootic in 1896. This is very far from the truth. The belief was widespread long before that eventful year, due to the disappearance of fly from parts of the Northern Transvaal follow-

ing depletion of the game by hunters. The following extracts are taken from Austen's "Monograph of the Tsetse Flies":—

As long ago as 1857 David Livingstone expressed himself as follows:—"It is probable that with the increase of guns the game will perish, as has happened in the south, and the tsetse, deprived of food, may become extinct simultaneously with the larger animals." ("Missionary Travels and Researches in South Africa," London: John Murray).

Later in 1865 he advanced the opinion that:—"The destruction of game by the advance of civilisation is the only chance of getting rid of the Tsetse." ("Narration of an Expedition to the Zambesi and its Tributaries"; London: John Murray).

James Chapman in 1868, with reference to tsetse flies:—"I have known them to shift their positions and encroach on new ground or leave parts where fire-arms have driven the game out of a district." ("Travels in the Interior of South Africa"; London: Bell & Daldy; Edward Stanford).

E. C. Buxton, in 1871, stated:—"There is a general opinion that the fly is connected in some way with the larger game, elephant, rhinoceros, etc." (*Entomologist*, Vol. V., April, 1871).

Thomas Baines, in 1877, wrote:—"The fly leaves a country if the game is driven out or the bush cut away, but returns if the conditions again become favourable to its existence." ("The Gold Regions of South-Eastern Africa," 1871. London, Edward Stanford).

F. B. Fynney, in 1878, wrote in reference to the Zoutpansberg district of the Transvaal:—"Many parts of this district, as well as Waterberg, are infested with the tsetse fly, but there is scarcely need to attach so much importance to this fact as is commonly done, because the fly is merely a temporary and ephermeral scourge, and always disappears with the large game. Many parts which six years ago were known as fly country are now entirely free." ("The Geographical and Economic Features of the Transvaal, the New British Dependency in South Africa": Proceedings of the Royal Geographical Society, Vol. XXII.).

In 1888 F. Jeppes wrote:—"Game has almost disappeared, frightened by the reports of the dynamite and the prospector's gun and the Tsetse Fly has gone with the game, save in some parts of the valley." ("The Kaap Goldfields of the Transvaal," Proc. Royal Geog. Soc. and Monthly Review of Geography. New Series, Vol. X.).

E. A. Maund, 1891:—"The Tsetse Fly whose bite is so deadly to domestic animals will disappear with the game. The Transvaal since the game has been so shot out, is now nearly free from this pest." ("On Matabele and Mashona Lands." Proc. Royal Geog. Soc. and Monthly Record of Geography, New Monthly Series, Vol. XLLL.).

W. Cotton Oswell, 1894:—"The Tsetse, that great enemy to the cattle breeder, will disappear before the approach of civilisation and the killing off of the game. especially the buffalo, its standing dish, as it has done many times already in African lore. I am speaking of the tracts south of the Zambesi." ("Big Game Shooting," Vol. 1. The Badminton Library of Sports and Pastimes. London, Longmens, Green & Co.).

F. C. Selous, of course, associated tsetse fly with big game, but more especially with buffalo.

The above quotations, of course, carry no great weight scientifically, but they show clearly that the belief in the dependence of tsetse on big game was widespread before the Rinderpest epizootic in 1896, and that the sequel to that epizootic was, therefore, not the original foundation of this belief.

In 1896 the Rinderpest epizootic occurred and destroyed a large proportion of the game. It was followed more or less immediately by the complete disappearance of tsetse fly from the Northern Transvaal and the southern part of the Colony, whilst in the north of the Colony the fly infested area shrank to a few isolated spots in the districts of Sebungwe, Hartley and Lomagundi. It is difficult to account for the tremendous effect on the tsetse fly of the Rinderpest epizootic, because a considerable proportion of the game escaped destruction, but as the meteorological records indicate a very ordinary season for 1896-7, it is also difficult to put forward any alternative

explanation but that the disappearance of the fly was the direct result of the Rinderpest. As a matter of fact, an epizootic of Rinderpest amongst the game and domestic animals in Uganda, 1917-18, was also followed by marked reduction of the fly (*morsitans*). (Duke, 1919.) Similar reduction of the fly also followed an epizootic of Rinderpest amongst the game in the west Nile district of Uganda in 1925-26. (Kennedy, 1929.)

Authoritative Views on the Relation between Tsetse and Game.—It is a common practice in propaganda directed against any destruction of game for the purpose of controlling tsetse fly to assert that authorities are disagreed amongst themselves concerning the dependence of tsetse fly on game. It is proposed in the present article to show definitely that this is not the case. It should be pointed out in this connection that admission of the dependence of the fly on game does not necessarily commit anyone to the opinion that it is feasible by game destruction to get rid of the fly. This point will be dealt with later. It is also necessary to define what is meant by an "authority" on the subject, because the public is very apt to be impressed by the names of scientific men who have not really studied tsétse fly at first hand.

The real authorities on the subject are obviously those who are sufficiently qualified in the first place, have personally studied the habits of tsetse flies for a considerable length of time in the field and have made substantial contributions to the science of the subject.

The largest organisation existing for the sole purpose of studying the habits, etc., and methods of control of tsetse flies is the Tsetse Research Department in Tanganyika Territory, of which Mr. C. F. M. Swynnerton is the Director.

Another and rather smaller organisation, termed the "Tsetse Fly Investigation," has been in existence in Nigeria for a number of years. Dr. Ll. Lloyd, D.Sc., who previous to the war spent several years in Northern Rhodesia studying the habits of tsetse fly, was formerly at the head of this investigation.

A certain amount of work has been carried out in most of the African States where tsetse flies occur, but the following

additional investigators may be specially mentioned. French West Africa, Dr. E. Roubaud, Dr. E. Bouet; Belgian Congo, Dr. Rodhain and Dr. J. Schwetz; Nyasaland, Dr. W. A. Lamborn; Zululand (*G. pallidipes*), Mr. R. H. T. P. Harris. In Southern Rhodesia attention has been directed to the problem during the past twenty-five years.

Drs. Bouet and Roubaud were amongst the pioneer investigators. The following may be quoted from their workings:—"More even than *G. tachinoides* and *G. longipalpis*, which are 'wild' species, having no habitual connection with man, *G. morsitans*, par excellence, the big game fly" . . . . "all causes capable of producing variation in the distribution of big game—hunting forays, epidemics, railway extensions, etc.—will necessarily also have a repercussion on the dispersion of *G. morsitans* which, in view of this, must be considered much less stable than that of the other tsetse flies." ("Les mouches tsetses en Afrique occidentale francaise." Bull. du Comitie d'Etudes Hist. et Scient. de l'Afrique Occidentale Francaise. Paris, 1921.)

The views of Dr. Ll. Lloyd and his colleagues of the Tsetse Fly Investigation in Nigeria have been expressed plainly and may be summed up in a quotation from their joint report published in 1927:—"Whatever we may wish, a tsetse infested country that fosters its game can only retrogress, and if the game in Northern Nigeria increases many large tracts of country at present populous and full of cattle will be reduced to the pitiable condition of some of the East African colonies, as for example, the eastern half of Northern Rhodesia. After five years of study of conditions in the country we have been compelled to recommend to the Government that all laws that might lead to the increase of the wild ungulates should be abolished, except in carefully selected game reserves." ("Experiments in the Control of Tsetse Fly," Ll. Lloyd, D.Sc.; W. B. Johnson, M.B.B.S., F.R.C.S.; and P. H. Rawson, M.C., M.R.C.S., L.R.C.P. Bulletin of Entomological Research, Vol. XVII., 1927.)

Mr. Swynnerton and his colleagues in Tanganyika Territory have quite frankly approached the problem from the point of view of endeavouring to find methods of controlling tsetse

fly without destroying game. Mr. Swynnerton, however, leaves no doubt as to his opinion of the result if the larger mammals can be excluded from any area:—"That the fencing of a small patch of country and the extermination of all large and largish animals within it, would lead to the disappearance of the tsetse contained, if man is excluded and, in the case of reptile-eating tsetses, reptiles as well, is to my mind a foregone conclusion." (C. F. M. Swynnerton, "The Tsetse Fly Problem in the Nzega sub-district, Tanganyika Territory." Bull. Ent. Res., XVI., 1925.)

Man is, of course, a "largish" animal zoologically. This statement includes all "largish" mammals and is not limited to game animals.

"Complete game destruction would almost certainly eliminate fly." (C. H. N. Jackson, Ph.D., M.Sc., F.R.E.S., Tsetse Research Department, Tanganyika. "The Causes and Implications of Hunger in Tsetse Flies." Bull. Ent. Res. XXIV., p. 14, 1933.)

Dr. T. A. M. Nash, of the same Department, has not apparently published an opinion in a few words on this question, but his researches have done much to establish the very close relation between tsetse fly and game, and in fact to explain the mechanism of this dependence. The dependence of the fly on the game is more or less accepted as the basis for much research and argument both in the case of Dr. Nash and of his co-workers. This matter will, however, be discussed in more detail later.

Dr. J. Schwetz, in 1927, published the result of an investigation into the causes of the marked retrogression of *morsitans* around Elizabethville, in the Katanga, which he traced to the shooting off of the game. The publication is in French and the writer is responsible for the translation of the following extract:—"For several years I attached little importance to the game factor and I was even astonished that the English attached so much importance to it." . . . "But the natural experience of Elizabethville forces me to change my previous point of view and to admit that between *G. palpalis* and *G. morsitans* there exists, besides water and vegetation, a further biological difference, not easily definable at the

moment, but which consists in a much greater dependence on wild animals on the part of *G. morsitans* than on the part of *G. palpalis*, a dependence so great and so strict that the extermination of game does not permit of *G. morsitans* adapting itself to domestic animals and man and makes it disappear." ("Etudes et Notes d'Entomologie Médicale sur le Katanga." Office de Publicité, Bruxelles, 1927.)

The views of Drs. J. Rodhain and J. Bequaert in reference to the disappearance of fly around Elizabethville are similar.

Dr. W. A. Lamborn, in Nyasaland, has not apparently furnished any brief statement expressing his views on this point, but in a paper of his published in 1916, appears a section headed "Relationship of the Fly to the Larger Mammals," which discloses at least a very strong leaning towards the view that the fly is so dependent. (W. A. Lamborn, M.R.C.S., L.R.C.P. "Third Report on *Glossina* Investigations in Nyasaland." Bull. Ent. Res. No. VII., 1916-17.)

It may be mentioned that in 1930 a large area of country, reported to be about 2,000 sq. miles in extent, was thrown open to free shooting in Nyasaland with the object of checking tsetse fly encroachment.

Mr. R. H. T. P. Harris, in Zululand, has been dealing with *G. pallidipes* and not *G. morsitans*. His researches cover a considerable number of years. The expression of his views is quite unequivocal:—"No longer to the writer's mind is there any mystery to the reported disappearance of the allied *G. morsitans* from the northern valleys of the Transvaal, when the early pioneers decimated the game, nor from the Eastern Transvaal when the Rinderpest performed the same service." . . . . "I have been forced to the conclusion, now firmly established in my mind, that the only general means of control worthy of adoption is the one now advocated, that of thinning out the food supply beyond the point where it can support the fly." (R. H. T. P. Harris, F.E.S., "Report on the Bionomics of the Tsetse Fly." Pietermaritzburg. June, 1930.)

The only entomologist known to the writer, who has studied the question in the field, and has expressed definite views which at first sight appear to be in opposition to the

above, is Dr. S. A. Neave, now Assistant Director, Imperial Institute of Entomology, London. Writing in 1912 of his experience in Nyasaland, Dr. Neave states:—"With regard to the relation of *G. morsitans* with game, I must unhesitatingly group myself with those who consider that the presence or absence of big game is not the primary factor in determining the distribution of the fly." (S. A. Neave, M.A., B.Sc., Oxon. "Notes on the Bloodsucking Insects of the Eastern Tropical Africa." Bull. Ent. Res., No. III., 1912.) This statement, as it stands, is not definitely at variance with the opinions of other investigators, although it appears to be so at first sight. Seeing that several factors are each essential for the permanent occurrence of *morsitans*, it is impossible to say that one or another is the "primary factor" determining the distribution of this species. Game is certainly not the only factor. This point will be dealt with later.

The above list of authorities is very far from exhaustive, but it includes the names of those who have spent most time studying *morsitans*. The names of the following must, however, not be omitted, namely:—

(1) Dr. J. J. Simpson, who spent several years in West Africa studying tsetse flies amongst other insects, etc., of medical importance, and has made definite contributions to our knowledge of tsetse flies.

(2) Mr. W. F. Fiske, who has done a great deal of work extending over a number of years in Uganda, but principally in respect to *G. palpalis*, and

(3) Dr. Lyndhurst Duke, of Uganda, who has published "An Enquiry into the Relationship of *G. morsitans* and Ungulate Game with special reference to Rinderpest." Bull. Ent. Res., Vol. X., 1919.

Dr. Simpson experimented with various species of tsetse flies and found that they did not feed on birds, even fowls, unless these were tied down. He also remarks on the comparative absence of reptiles from the haunts of *G. morsitans*, and showed that the blood taken by this species in the field was about 98% mammalian. ("Bionomics of Tsetse and other Parasitological Notes on the Gold Coast." Bull. Ent. Res., Vol. X., 1918.)

Dr. Duke showed that the Rinderpest epizootic in part of Uganda in 1917 had had a very definite effect in reducing the fly. He fed *G. palpalis* on the blood of animals suffering from rinderpest without any apparent effect on the fly, and definitely recommends local game destruction as one of a combination of measures against the fly (*morsitans*). (Duke, 1919.)

Very recently Mr. J. Carmichael, of the Uganda Veterinary Service, has experimented with feeding *G. morsitans* on the blood of animals infected with rinderpest and no effect on either the health or reproductive powers of the fly was apparent. (Carmichael, 1933.)

Some Points in the Life Economy of the Tsetse Fly.—Having now given a brief account of the growth of the conviction that *G. morsitans* is dependent for its continued existence on the presence of a sufficient number of comparatively large mammals in its habitat, and having furnished quotations of modern scientific opinion on this point, it will probably interest the reader, who has persevered thus far, to obtain some information of recent views concerning the life economy of the fly and the reason why comparatively large mammals are necessary to it.

In the first place it should be realised that tsetse flies are in reality active and independent parasites on red-blooded mammals. They are apparently specialised beyond the stage of some of the blood-sucking flies such as mosquitoes, blind-flies and horse-flies (*Tabanidæ*), stable-flies, etc., to the extent that their digestive organs cannot deal with liquids other than blood. Tsetse flies can be induced to feed on other liquids sometimes by the procedure of heating the liquid and covering it with a membrane, which the fly can pierce with its proboscis. If induced to suck up any considerable quantity of water in this way the fly is killed. (Lester and Lloyd, 1928. Wigglesworth, 1929.) The exact reason for this result need not be dealt with here.

Some years ago an independent investigator reported that he had demonstrated that in Zululand the local tsetse fly, *G. pallidipes*, feeds upon certain species of latex-bearing (milky-juiced) plants and even went further and stated that

they obtain their infection with trypanosomes, the organisms of fly disease, from these plants. These plants as a matter of fact were previously known to be subject to infestation with certain organisms bearing a close resemblance to trypanosomes and termed *Leptomonas* (or *Phytomonas*), which are apparently transmitted by certain plant bugs. None the less, in view of the publicity afforded to this alleged discovery in the Natal press, the question was investigated by Mr. R. H. Harris and Mr. A. B. M. Whitnall, M.Sc., of the Veterinary Service, Union of South Africa, with the result that it was duly shown that the flies could not feed on these plants and, in fact, if induced to suck up any latex from such plants, the effect was toxic to the flies (Harris and Whitnall, 1934).

There is no scientific evidence indicating that tsetse flies can feed and maintain themselves on vegetable juices. In fact, "there is no evidence whatsoever that tsetse can survive for any length of time in the complete absence of animals." (Special publication of the American Committee on International Wild Life Protection, Vol. I., No. 1, p. 32, Department of Tropical Medicine, Harvard University, U.S.A., 1931.)

If the tsetse fly were a true external parasite, adhering to its host, it could live on any animal, bird, reptile, etc., furnishing suitable blood. The tsetse, however, after filling itself to repletion with blood, has to leave its host and retire to some sheltered spot to digest its meal, and it is several days before it becomes hungry again. In the meantime, of course. it loses touch with the animal on which it has fed and needs to find another host for the next meal. Newly-emerged flies, of course, need to find an animal for their first feed.

Now, it has been shown by investigators that the flies are guided to their host from any considerable distance apparently solely by sight (Harris, 1930. Nash, 1930.) Scent may, however, attract them from a short distance, possibly limited to a few feet.

Hungry flies, in the case of *morsitans* at least, are very strongly attracted by large moving objects, as anyone may ascertain by driving a motor car along a fly-infested road. They are also attracted by moving man and animal. In addition, they may find hosts through the fact that they are attracted by shady objects, as a large mammal, of course, provides shade. Mr. Harris, working with *G. pallidipes* in Zululand, has made a great point of the attraction exercised on this fly by objects presenting a conspicuous patch of horizontal shade and his well-known tsetse fly traps are based on this attraction.

On the other hand *G. morsitans* when hungry, will undoubtedly feed *if it can* on any warm-blooded animal (including birds), and even on reptiles with which it comes into sufficiently close contact. It is not certain that the blood of birds and reptiles is best suited to it as a diet, but the flies will take such blood none the less. The disabilities that the flies suffer from in regard to feeding regularly on such sources of blood probably include the following:—

(1) The fact that they apparently have to detect their hosts, except from a very short distance by sight and are mainly attracted by movement, the larger the moving object within limits the more attractive it is, and *vice versa*;

(2) The practical absence of large reptiles from *morsitans* country;

(3) The agility and irritability of small mammals, as well as their nocturnal activity, in most cases;

(4) As far as birds are concerned it is probably only large and comparatively quiescent ground-haunting birds which would be commonly noticed by the fly. Apart from Guinea Fowl, Francolin, etc., such birds are not usually plentiful. Guinea fowl and Francolin suggest possibilities, especially after the grass is burnt, but there is some evidence (Simpson, 1918), that flies do not normally succeed in feeding on such birds, possibly due to the protection afforded by the feathers, a protection which would, of course,

be shared by most birds.* Largish birds with naked skin exposed either in the form of a wattle or otherwise, such as vultures, ground hornbills, etc., may sometimes afford a meal to tsetse flies, also perhaps ostriches and some other species.

The behaviour of the hungry flies (*G. morsitans*) is in full accordance with this visual attraction to large grazing animals. Shade is a necessity to the flies in any condition, but good visibility is also necessary to hungry flies to enable them to see their prey. Consequently the hungry flies tend to range through open forest and along the edge of openings in the forest, such as glades, vleis, etc., where animals are more conspicuous than in the denser bush, apparently flying with great speed under such circumstances (Nash, 1930 and 1933. Jackson, 1930.) Once they have secured a feed the tendency is to retire at once to the shade to digest the meal.

In seeking an environment which affords good visibility, it is suggested that the flies are not consciously seeking food, and, that failing to find game, they do not deliberately search for food in secluded places. The hungry flies in this instance are obeying a blind instinct, induced by hunger, to range through comparatively open places in, or on the edge of, the forest, and as long as they are hungry they must continue to obey this instinct.

This procedure is obviously the reverse of that which would lead the flies to find the smaller nocturnal mammals, birds, etc., hidden in their diurnal retreats. The hungrier the flies become the greater their instinct to fly through open places, and the less their chance of finding anything to feed upon other than animals, etc., which frequent open places.

Examination of the blood of the digestive tracts of tsetse flies caught under natural conditions, shows that they do occasionally obtain a feed from certain birds, but the number of flies showing avian blood is insignificant compared with

*The writer has found *morsitans* extremely hungry in spots where guinea fowl and francolin were concentrated in enormous numbers. The numbers of females caught in one locality of this nature slightly exceeded the number of males caught, an indication of great hunger. The hunger was in any case apparent from the manner in which the flies attacked and "bit" the party. The weather, it may be added, was extremely hot and dry.

those showing mammalian blood. Also in Southern Rhodesia, at least as far as the point has been investigated, the destruction of the game has not resulted in any appreciable increase in the proportion of avian blood obtained. The observations in this conection were made by Mr. J. K. Chorley, of the Entomological Branch, in the Lomagundi district in 1928-1929. Elsewhere a comparatively small increase in similar circumstances has been recorded (Lloyd, 1927).

It is to be realised that tsetse flies are exceedingly slow-breeding insects. The females do not lay eggs like house-flies and most other flies, but produce one full-grown maggot at a time. Even in the height of the breeding season these maggots are only produced about once in a fortnight and twelve offspring is probably a large family for a tsetse fly, compared with, say, six hundred in the case of a house-fly.

To maintain vitality and breeding activity, more or less regular meals are required. Recent research in Tanganyika Territory suggests that in the dry season at least, the flies become hungry about every five days. In confinement tsetse flies usually need a full feed every two or three days.

Far more than with most insects, maintenance of the population amongst tsetse is dependent upon the well-being and longevity of the adult flies. Unless a sufficiency of readily detected hosts is available the flies' meals are irregular and too widely spaced, leading inevitably to a serious decline in reproduction and, no doubt, premature death of many adult flies. It should be stated that the fully grown maggot deposited by the tsetse needs no food and is only active for a few hours, during which time it may wriggle beneath the surface of loose soil or vegetable debris on the ground. It then becomes a *puparium* (chrysalis stage of butterflies) from which, after a period varying from about three weeks to several months, according to the temperature, the adult fly emerges. The puparia are found in shady sites, *e.g.*, under fallen trees, in hollow trees, under shady rocks or the banks of dry water courses, etc. It has been found by various observers that puparia are much more abundant in localities where game is plentiful than where it is scarce, a fact which indicates the

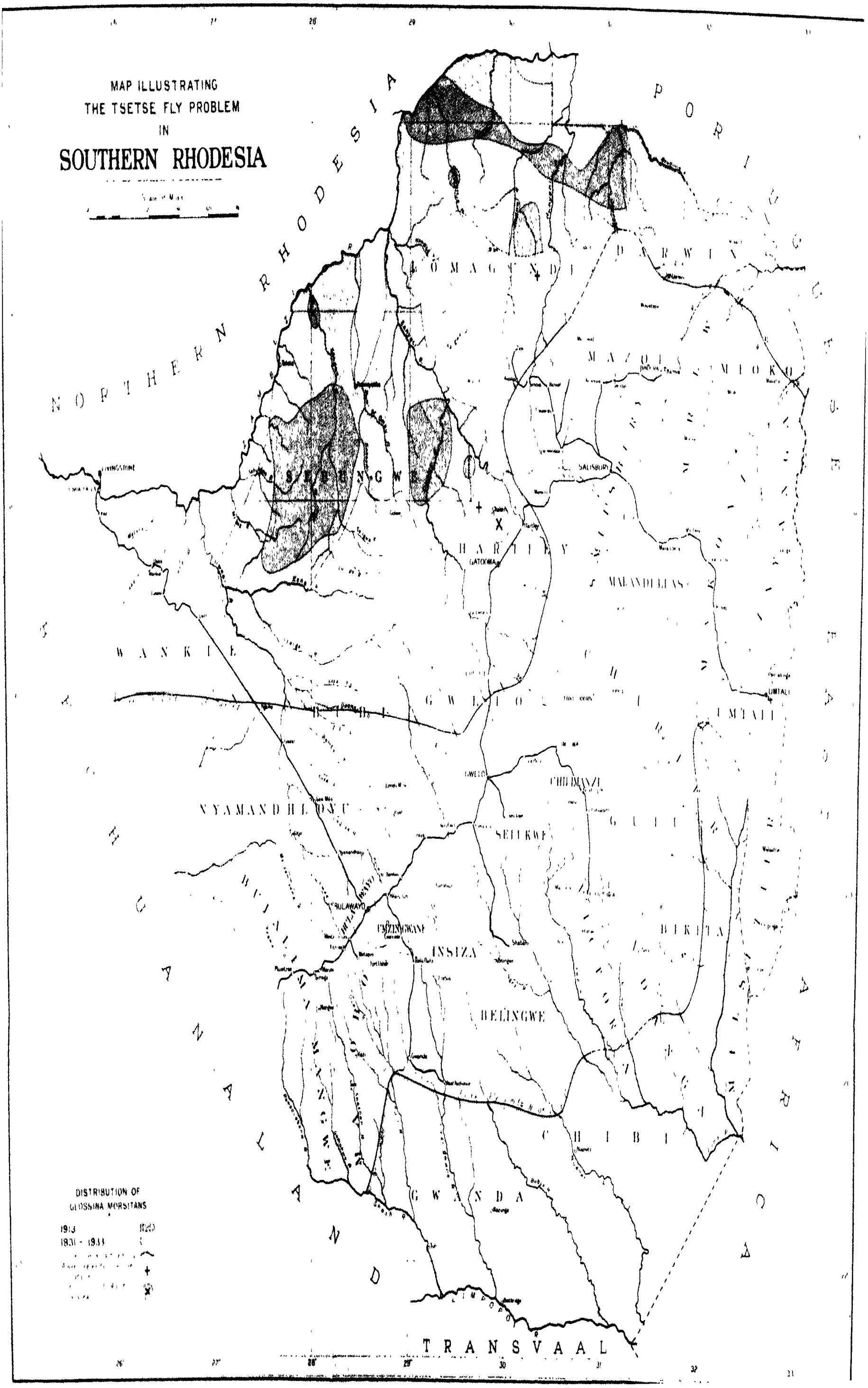
effect of a shortage of food on the breeding of the insect. (Lloyd, 1914; Lamborn, 1915; Swynnerton, 1921; Harris, 1930.)

It should be pointed out that not only food but also water is necessary to all living organisms. It is not certain whether tsetse flies will drink even a small quantity of water where this is available. We have seen that they cannot drink any quantity without detriment. In the case of *G. morsitans*, which inhabits very dry tracts of country in certain instances, it is quite certain that water, as such, is not always available during considerable periods in the late dry season. Yet the flies are exposed to a hot, dry and highly evaporative environment at that time of year. In such circumstances any organism suffers gradual loss of water from its tissues and there is a limit below which this process cannot proceed without being harmful and finally fatal to the insect.

The tsetse's sole source of water under such conditions is apparently blood, about 80% of which, in the case of an ox for instance, consists of water. Insufficient food under these conditions therefore means insufficient water.

It has been shown in Tanganyika (Nash, 1931) that even in the presence of a sufficiency of game, prolonged hot dry periods (high evaporation rate) bring about a marked reduction in the number of the flies, and that therefore such conditions are in themselves inimical to the fly. If a shortage of food and water is added, it is obvious that the flies are likely to suffer very much more during this period of natural stress. Possibly thirst and excessive loss of water is more effective even than hunger in affecting the vitality of the fly when game is very scarce in the late dry season.

It seems quite possible that the surprisingly complete effect on the fly of the Rinderpest epizootic in the Limpopo and Sabi valleys was due to the fact that the fly only survived the late dry season in that hot dry country with difficulty in any case, and that its survival depended upon the continued presence in numbers, in the comparatively scanty fly refuges in the late dry season, of animals such as warthog, for instance, which suffered particularly severely from the epizootic.



MAP ILLUSTRATING
THE TSETSE FLY PROBLEM
IN
SOUTHERN RHODESIA
NORTHERN RHODESIA
PORTUGUESE EAST AFRICA
BECHUANALAND
TRANSVAAL
DARWIN
LOMAGUNDI
MAZOE
MTOKO
SEBUNGWE
HARTLEY
GATOOMA
SALISBURY
MARANDELLAS
WANKIE
GWELO
UMTALI
CHILIMANZI
NYAMANDHLOVU
SELUKWE
BULAWAYO
UMZINGWANE
INSIZA
BIKITA
BELINGWE
CHIBI
GWANDA
LIVINGSTONE
LIMPOPO R
DISTRIBUTION OF
GLOSSINA MORSITANS
1913
1931 - 1933

it finally disappears. It is interesting to find this view supported by Dr. C. H. N. Jackson, of the Tanganyika Tsetse Research staff, *e.g.*—"Broadly speaking, if food is adequate to support permanently a few tsetse it is adequate for any number. If food is absent or inadequate for a large population of tsetse, then not even a few can exist." (Jackson, 1933.) This fact distinguishes tsetse flies from most, if not all other indigenous insect pests, namely, that complete eradication from extensive areas is a possibility. It may be noted also that unlike other insect pests, complete eradication of tsetse is usually necessary to achieve really practical results, at least in reference to animal trypanosomiasis. As long as any tsetse remains, susceptible cattle cannot be kept in any area. In this statement, the writer is referring to conditions in Southern Rhodesia where the "grade" cattle owned by both European and natives appear to be appreciably more susceptible to trypanosomiasis than native cattle in Tanganyika, for example.

Intensive hunting ot game has another effect besides reduction in the number of the animals. It tends to alter their habits very markedly. Under undisturbed conditions the grazing animals come down to the grazing grounds during the daytime and do not as a matter of fact usually move very far away. The grazing grounds and their vicinity are the main ranging and feeding grounds of the fly. Under persecution the game tends to return to the hills or into the less open forest during the day and to come down to the grazing grounds after dark, leaving again before sunrise. Under these circumstances the fly, which is diurnal in habit, is not in a position to make the best use of even the reduced amount of game remaining. It is judged that this development is a potent factor in enhancing the effect of game reduction by hunting methods.

When operations against game have been undertaken in a zone straddling the limits (at that particular time) of a fly area, which has been in process of extending, arrest of the spread of the fly has occurred almost immediately in every instance. This is presumably due to the check administered to the breeding of the insect.

Marked reduction in the density of the fly throughout most of the area may commence within a year or be more or less delayed according to the nature of the country. It follows inevitably, however, if the game can be reduced to and maintained at a certain minimum the flies becomes very hungry and the percentage of female flies attracted to man rises appreciably.

The portion of the game depletion zone several miles wide adjacent to the main fly area, is apparently subject to constant invasion by flies bred in the undisturbed country beyond, and this apparently prevents the fly from being eradicated up to the limit of the zone of operations. It takes several years under the most favourable conditions to bring about any considerable and definite *retrogression* of the fly, but this follows in due course if the zone is wide enough. During the earlier undertakings a zone of about 10 miles was used, but this width was found to be insufficient to drive the fly back far enough to place farms on the protected side of the zone beyond the reach of wandering flies. A twenty mile wide zone is now considered to be necessary to effect this purpose.

The comparatively slow rate of fly reduction is apparently due to (1) constant invasion of a portion of the zone from the country beyond; (2) incomplete removal of the larger mammals; and (3) occasional feeds obtained from sources other than the larger mammals. The flies can still obtain a certain amount of food in the depleted zone, but they cannot obtain enough. They constitute a slowly starving community, with the death roll apparently exceeding the birth rate, and so they gradually die out.

It is, however, highly probable that, if a portion of the fly area of suitable size could be isolated against invasion by flies bred outside, very much quicker results would be obtained from game reduction methods. Unfortunately this cannot be done at present within economic limits, and in Southern Rhodesia there are no isolated fly areas of limited extent involved in the problem.

One point should, however, be mentioned, namely, that for a period after operations of the above nature have been inaugurated, trypanosomiasis amongst cattle on the farms is liable to occur further afield than previously. This is almost certainly due to the wider ranging of the hungry flies through game depleted country. It is a temporary phase only, which is soon corrected by reduction in numbers and retrogression of the fly.

Does Intensive Hunting of Game in the Fly Area Scatter Both Game and Fly?—This is another possibility which has been suggested, although in point of fact it is not to the writer's mind based on sound premises. In any case, no discernible effect in scattering fly, that is to say, establishing the insect in new localities, has followed the operations in this Colony. In due course, the effect has in fact been very much the reverse.

In 1920 the writer expressed the opinion on the basis of theoretical conditions, that the fly could probably not definitely be spread by the movement of game, although it is known that flies tend to follow moving game for some miles (Jack, 1920). The inability of the fly to keep in touch with individual hosts has already been dealt with, as also has the difficulty of establishing fly in new country even when carried into it in large numbers. On broad considerations it also seems an impossibility that definite fly areas should persist if the fly were able to attach itself to game and follow it in its wanderings. The fly is eventually dependent on the presence of game, but the fly does not "follow the game" in the sense in which the phrase is generally used.

The writer's view seems to be supported in a general way by recent work in Tanganyika, where the movements of game have been shown to have little or no effect on the general distribution of the fly. Furthermore, the rate of spread of fly areas in Tanganyika has been found to be in no way correlated with the mobility of game (Jackson, 1933 (2)), a point which the writer has also made in reference to the expansion of the fly areas in Southern Rhodesia.

As this article deals with the question of "tsetse fly and game" only, it is not intended to discuss the practicability

of alternative measures in this Colony. These have been dealt with in other articles both in the *Rhodesia Agricultural Journal* and elsewhere.

The present operations have had the result of holding up the advance of fly, and of driving it back where necessary. Any alternative measures which may prove feasible can now be applied gradually. Possibly, in the course of time, effective barriers to the fly's advance may be developed and permit of corresponding shortening of the game reduction cordons. Previous to control of the fly having been established, any gradually developed barriers would have been liable to be far behind the fly limit when completed.

It is now known that arrest of the fly's spread can be accomplished, and that if necessary areas can be cleared of fly by game reduction measures. This is a highly important advance in our knowledge.

There are several points for the more ardent of the game protection protagonists which may be mentioned in conclusion.

The great fear is apparently that game will be exterminated or seriously depleted in the Colony by the Government's operations. There is no danger of this occurring. The operations are strictly limited in extent, and are under effective control.

The area in which game is being kept down is not so large as the area set aside for permanent game sanctuaries elsewhere in the Colony. At the present time 4.6% of the total area of the Colony is permanent game sanctuary, and this is likely to be added to shortly. One-sixth of the whole Colony is at present Game Reserve under the Act and over the rest of the Colony, with the exception of certain occupied areas immediately behind the tsetse fly cordons, the game laws are in force. Game destruction in the Colony is, in fact, under much better control than was the case before the tsetse fly cordon was completed.

Experience has shown that if an area depleted of game is left alone for a few years, the animals return in numbers comparable with those present before (*e.g.*, Gwaai-Shangani

region, and to a lesser extent the western portion of the Hartley district). Game reduction in a limited area is an elastic measure.

Game destruction on a large scale is certainly highly repugnant, but it is still more repugnant to witness the ruin of settlers and depopulation of country in which civilised man has established a footing. That is the inevitable alternative to the present operations.

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SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 15. February, 1934.

Red Locust (*Nomadacris septemfasciata*).—The egg-laying by belated flying swarms mentioned in my January Report (No. 14) continued at least during the first half of February. By the end of February reports of flying swarms were no longer being received. Occasional solitary fliers have been seen in many parts of the country, being individuals left behind by flying swarms from November onwards. The egg-laying period this season has extended over fully three months, but the later layings have been comparatively insignificant.

The earlier hoppers were mostly in the 5th and 6th stages at the end of the month, while comparatively small numbers from later egg deposits were still hatching. Advanced moulting to the adult form commenced in some areas in the Zambesi Valley at the end of the month.

Thus there were present in the Colony during February old adults, eggs, hoppers in all stages, and newly moulted adults of the new generation.

Damage to Crops.—In some districts the District Controllers of Locust Operations are already satisfied that crops have been saved from the hopper stage. In others native crops have suffered rather severely. Europeans, in general, have been successful in protecting their crops from hoppers, but some considerable damage has been sustained in individual cases.

Damage by the apparently belated flying swarms has occurred to both European and native crops, but has been more or less confined to a few localities in the south-east.

In view of the fact that the locusts will commence to fly about one month earlier this season than last anxiety is felt concerning possible serious damage to maize by flying swarms, as these crops will not in general have matured beyond risk

of damage by the middle of March when the earlier flying swarms are expected to commence moving about.

Enemies. Few reports of enemies were received during the month, but it is likely that most of the later egg deposits were being attacked by *Stomatorhina* and possibly mites. There were no confirmed reports of enemies, parasites or disease in the hoppers, and the only enemies of fliers noted were red mites.

Tropcial Migratory Locust (*L. m. migratorioides*).—Hoppers of this species, unnoticed among swarms of Red Locust hoppers, commenced moulting to the adult stage at the beginning of the month. The new fliers remained, in general, with the hoppers amongst which they had developed, and which were mostly in the 4th and 5th stages. In a few cases, small "swarms" of one or two hundred fliers were seen separated from hoppers, but hopper swarms were invariably found nearby.

Sodium arsenite spray at the usual strength, *i.e.*, 3½ oz. (av.) to 4 gallons water, is reported to kill these adults.

Campaign.—The compaign against hoppers has continued vigorously. A slight reduction in the intensity of operations was possible by the end of the month in some districts, and in one the campaign has been brought to a successful conclusion.

Owing to the inability to obtain further supplies of dry arsenite of soda from the Union of South Africa cattle dip was being issued at the end of the month. This is reported as equally effective, in conformity with experience during past campaigns. One hundred and seventy (170) tons of arsenite of soda have been issued to date in the campaign apart from cattle dip, and at the end of the month seven thousand (7,000) bucket pumps are more or less in action, together with ten (10) handpower barrel sprayers mounted on lorries and five mounted on their own wheels. These large pumps are reported as highly efficient and useful; in fact, one D.C.L.O. estimates that one of these pumps on a lorry is equivalent to about one hundred (100) natives serving small pumps.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

JANUARY, 1934.

AFRICAN COAST FEVER.

No cases occurred.

TRYPANOSOMIASIS.

No cases reported.

HEARTWATER.

Several cases of Heartwater have occurred in Bulawayo and district, being introduced by cattle from the southern areas in which the bont tick is known to be prevalent.

ANTHRAX.

The incontact cattle at Mtoko, referred to in December report, were inoculated. One death occurred in cattle en route from Mtoko to Macheke, the remainder were passed through as free from disease.

HORSESICKNESS.

One death reported in Hartley district.

MALLEIN TEST.

Three horses were tested for Glanders on importation with no reaction.

TUBERCULOSIS.

6 bulls and 25 cows were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls 6, cows 25, horses 3, sheep 702, goats 25 and pigs 15.

EXPORTATIONS.

Bulls 13.

To the United Kingdom *via* Union Ports in cold storage: Pig carcases, 95; beef fore-quarters, 2,340; hind-quarters, 2,703; boned-quarters, 6,918; livers, 23,229 lbs.; tongues, 11,351 lbs.; hearts, 9,761 lbs.; skirts, 2,920 lbs.; shanks, 15,889 lbs.; tails, 4,512 lbs.; kidneys, 1,819 lbs.

Meat products from Liebig's Factory: Beef fat, 77,000 lbs.; tongues, 870 lbs.; meat meal, 99,300 lbs.; meat extract, 16,106 lbs.; beef powder, 28,338 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

FEBRUARY, 1934.

Pressure.—Mean pressure for the month was decidedly below normal, particularly in the East, where Umtali was 1.1 mb below normal.

The main features of the period January and February has been a succession of lows appearing on the north coast of Madagascar and moving down the Mocambique Channel; these lows are associated with south-east winds in Southern Rhodesia and have a bad effect on the rain.

Temperature.—The main temperature of the month was about normal.

Rainfall.—The rainfall amounted to 3.7 inches, or about 1.9 inches below the average for the month. The total since October 1st is 19.8 and the average is 22.5, making a deficiency of 2.7 on the season.

FEBRUARY, 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	98	63	87.3	68.1	77.7	76.4	75.4	69.3	74	66	...	2.05	4.1	9	...
Beit Bridge	961.4	...	103	62	91.0	69.4	80.2	...	78.1	68.7	62	64	4.5	.88	1.6	2	1,510
Bindura...	888.9	..	90	59	82.1	64.1	73.1	...	70.4	65.1	76	62	6.0	5.62	4.5	14	3,709
Bulawayo	867.4	867.7	87	53	80.5	60.7	70.6	70.3	69.0	62.7	71	59	6.5	1.49	4.1	5	4,425
Chipinga	890.0	...	88	58	77.3	62.2	69.7	...	68.5	64.6	83	62	5.5	7.77	8.3	16	3,684
Enkeldoorn	855.7	...	87	53	78.8	59.0	68.9	69.7	68.0	62.4	74	59	5.2	3.54	6.1	8	4,787
Fort Victoria	893.4	894.1	90	52	81.3	62.0	71.6	71.5	70.4	64.8	76	62	5.5	3.94	4.7	10	3,570
Gwaai Siding	901.6	...	93	52	86.8	62.3	74.5	...	72.1	65.8	72	62	4.1	2.61	4.0	11	3,280
Gwanda	904.1	...	92	55	83.0	63.7	73.4	...	71.1	65.2	74	62	5.2	2.27	3.7	8	3,228
Gwelo	860.9	861.7	86	53	79.6	59.5	69.5	70.9	67.9	62.3	74	59	5.3	2.15	5.3	7	4,627
Hartley	884.4	...	88	54	83.0	61.8	72.4	72.3	69.5	65.0	79	63	3.8	3.73	7.3	13	3,878
Inyanga	...	...	...	...	...	...	...	...	...	...	...	...	...	5.15	8.7	17	5,513
Marandellas	836.1	...	81	52	75.5	58.0	66.7	...	65.6	60.4	74	57	6.3	2.38	7.2	10	5,450
Miami	876.7	...	87	59	79.2	62.3	70.7	..	69.2	65.3	82	63	6.6	6.02	4.9	17	4,077
Mount Darwin ...	904.6	...	93	60	83.9	65.2	74.6	..	73.0	67.4	75	65	5.5	5.64	7.2	13	3,178
Mount Nuza	799.7	...	74	50	65.1	52.7	58.9	...	57.5	56.4	94	55	7.6	7.02	...	16	6,666
Mtoko	875.0	...	93	58	82.2	62.8	72.5	...	70.6	65.0	73	62	4.3	6.61	5.6	16	4,140
New Year's Gift...	...	...	91	60	83.0	64.5	73.8	...	72.3	67.1	76	65	...	2.70	5.0	12	2,690
Nuanetsi	959.0	...	103	59	89.9	67.7	78.8	...	76.5	69.2	69	66	5.8	1.78	2.2	4	1,650
Plumtree	862.4	...	86	54	80.7	61.3	71.0	...	69.7	62.7	68	58	4.8	3.85	4.2	9	4,549
Que Que	879.7	...	89	55	83.6	61.8	72.7	..	70.5	64.5	72	61	5.5	1.42	6.7	7	3,998
Riverbank...	...	...	92	51	85.5	62.8	74.1	73.5	72.1	64.4	67	60	...	1.50	4.5	7	4,090
Rusape...	859.8	...	88	50	78.0	59.2	68.6	...	66.2	62.2	80	60	5.6	5.13	5.4	8	4,630
Salisbury	852.9	853.8	85	51	79.1	59.7	69.4	69.4	68.6	62.7	72	59	6.2	7.73	5.2	11	4,885
Shabani	905.3	...	95	58	83.9	64.6	74.2	...	72.1	65.7	71	62	6.4	.86	4.5	7	3,192
Sinoia	885.8	...	89	57	83.3	63.1	73.2	...	71.1	65.4	74	63	4.8	6.39	7.3	14	3,793
Sipililo	...	...	85	60	79.0	62.6	70.8	...	70.1	65.4	79	63	5.0	5.02	8.1	15	3,875
Umtali...	890.7	891.8	91	57	81.7	62.5	72.1	71.5	70.5	65.7	78	63	6.3	2.34	6.1	13	3,670
Wankie	924.1	...	98	64	90.1	69.0	79.6	...	76.4	68.8	69	65	4.1	3.39	4.7	9	2,566

Rainfall in February, 1934, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Total
1	...	...	13	4	58	22	28	29	1	5	...	...	1	...	...	1	...	...	7	3	...	...	...	18	..	...	...	...	190
2	...	...	...	16	110	6	...	...	...	...	...	...	...	11	25	20	...	4	15	28	4	2	...	17	4	4	...	...	266
3	5	...	...	7	314	213	3	...	47	...	...	1	...	20	2	16	..	...	7	72	40	...	...	9	17	4	...	...	777
4	...	...	...	34	46	9	1	12	...	1	25	...	...	...	...	13	...	...	19	6	...	...	...	63	2	...	...	...	231
5	...	...	15	27	69	76	35	4	15	14	9	9	37	...	...	3	...	1	25	...	1	...	...	18	...	...	...	...	358
6	...	10	...	41	38	46	9	40	16	46	7	...	37	54	2	14	...	8	29	...	...	...	...	20	2	11	...	13	443
7	1	5	3	30	59	10	20	10	6	85	1	...	2	...	14	29	3	...	44	7	13	2	...	...	12	2	17	3	378
8	10	...	1	20	17	2	1	186	59	76	35	...	40	26	8	...	2	...	10	1	2	...	...	...	4	2	88	34	624
9	8	3	...	53	2	27	15	72	64	30	4	5	2	12	18	16	99	...	31	1	27	2	...	14	12	7	21	70	615
10	...	...	...	16	8	...	...	7	124	144	5	...	2	42	107	50	...	...	33	21	7	...	...	...	11	4	12	24	617
Mean	2	2	6	25	56	29	17	29	22	30	6	2	11	9	13	13	14	1	22	8	7	1	—	17	5	3	9	13	372

Farming Calendar.

APRIL.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands;

irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 or 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial

control. The spray must hit the insect to kill. Do no re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growh may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Officers Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable from the Poultry Officers.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producing first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

it finally disappears. It is interesting to find this view supported by Dr. C. H. N. Jackson, of the Tanganyika Tsetse Research staff, *e.g.*—"Broadly speaking, if food is adequate to support permanently a few tsetse it is adequate for any number. If food is absent or inadequate for a large population of tsetse, then not even a few can exist." (Jackson, 1933.) This fact distinguishes tsetse flies from most, if not all other indigenous insect pests, namely, that complete eradication from extensive areas is a possibility. It may be noted also that unlike other insect pests, complete eradication of tsetse is usually necessary to achieve really practical results, at least in reference to animal trypanosomiasis. As long as any tsetse remains, susceptible cattle cannot be kept in any area. In this statement, the writer is referring to conditions in Southern Rhodesia where the "grade" cattle owned by both European and natives appear to be appreciably more susceptible to trypanosomiasis than native cattle in Tanganyika, for example.

Intensive hunting of game has another effect besides reduction in the number of the animals. It tends to alter their habits very markedly. Under undisturbed conditions the grazing animals come down to the grazing grounds during the daytime and do not as a matter of fact usually move very far away. The grazing grounds and their vicinity are the main ranging and feeding grounds of the fly. Under persecution the game tends to return to the hills or into the less open forest during the day and to come down to the grazing grounds after dark, leaving again before sunrise. Under these circumstances the fly, which is diurnal in habit, is not in a position to make the best use of even the reduced amount of game remaining. It is judged that this development is a potent factor in enhancing the effect of game reduction by hunting methods.

When operations against game have been undertaken in a zone straddling the limits (at that particular time) of a fly area, which has been in process of extending, arrest of the spread of the fly has occurred almost immediately in every instance. This is presumably due to the check administered to the breeding of the insect.

Marked reduction in the density of the fly throughout most of the area may commence within a year or be more or less delayed according to the nature of the country. It follows inevitably, however, if the game can be reduced to and maintained at a certain minimum the flies becomes very hungry and the percentage of female flies attracted to man rises appreciably.

The portion of the game depletion zone several miles wide adjacent to the main fly area, is apparently subject to constant invasion by flies bred in the undisturbed country beyond, and this apparently prevents the fly from being eradicated up to the limit of the zone of operations. It takes several years under the most favourable conditions to bring about any considerable and definite *retrogression* of the fly, but this follows in due course if the zone is wide enough. During the earlier undertakings a zone of about 10 miles was used, but this width was found to be insufficient to drive the fly back far enough to place farms on the protected side of the zone beyond the reach of wandering flies. A twenty mile wide zone is now considered to be necessary to effect this purpose.

The comparatively slow rate of fly reduction is apparently due to (1) constant invasion of a portion of the zone from the country beyond; (2) incomplete removal of the larger mammals; and (3) occasional feeds obtained from sources other than the larger mammals. The flies can still obtain a certain amount of food in the depleted zone, but they cannot obtain enough. They constitute a slowly starving community, with the death roll apparently exceeding the birth rate, and so they gradually die out.

It is, however, highly probable that, if a portion of the fly area of suitable size could be isolated against invasion by flies bred outside, very much quicker results would be obtained from game reduction methods. Unfortunately this cannot be done at present within economic limits, and in Southern Rhodesia there are no isolated fly areas of limited extent involved in the problem.

One point should, however, be mentioned, namely, that for a period after operations of the above nature have been inaugurated, trypanosomiasis amongst cattle on the farms is liable to occur further afield than previously. This is almost certainly due to the wider ranging of the hungry flies through game depleted country. It is a temporary phase only, which is soon corrected by reduction in numbers and retrogression of the fly.

Does Intensive Hunting of Game in the Fly Area Scatter Both Game and Fly?—This is another possibility which has been suggested, although in point of fact it is not to the writer's mind based on sound premises. In any case, no discernible effect in scattering fly, that is to say, establishing the insect in new localities, has followed the operations in this Colony. In due course, the effect has in fact been very much the reverse.

In 1920 the writer expressed the opinion on the basis of theoretical conditions, that the fly could probably not definitely be spread by the movement of game, although it is known that flies tend to follow moving game for some miles (Jack, 1920). The inability of the fly to keep in touch with individual hosts has already been dealt with, as also has the difficulty of establishing fly in new country even when carried into it in large numbers. On broad considerations it also seems an impossibility that definite fly areas should persist if the fly were able to attach itself to game and follow it in its wanderings. The fly is eventually dependent on the presence of game, but the fly does not "follow the game" in the sense in which the phrase is generally used.

The writer's view seems to be supported in a general way by recent work in Tanganyika, where the movements of game have been shown to have little or no effect on the general distribution of the fly. Furthermore, the rate of spread of fly areas in Tanganyika has been found to be in no way correlated with the mobility of game (Jackson, 1933 (2)), a point which the writer has also made in reference to the expansion of the fly areas in Southern Rhodesia.

As this article deals with the question of "tsetse fly and game" only, it is not intended to discuss the practicability

of alternative measures in this Colony. These have been dealt with in other articles both in the *Rhodesia Agricultural Journal* and elsewhere.

The present operations have had the result of holding up the advance of fly, and of driving it back where necessary. Any alternative measures which may prove feasible can now be applied gradually. Possibly, in the course of time, effective barriers to the fly's advance may be developed and permit of corresponding shortening of the game reduction cordons. Previous to control of the fly having been established, any gradually developed barriers would have been liable to be far behind the fly limit when completed.

It is now known that arrest of the fly's spread can be accomplished, and that if necessary areas can be cleared of fly by game reduction measures. This is a highly important advance in our knowledge.

There are several points for the more ardent of the game protection protagonists which may be mentioned in conclusion.

The great fear is apparently that game will be exterminated or seriously depleted in the Colony by the Government's operations. There is no danger of this occurring. The operations are strictly limited in extent, and are under effective control.

The area in which game is being kept down is not so large as the area set aside for permanent game sanctuaries elsewhere in the Colony. At the present time 4.6% of the total area of the Colony is permanent game sanctuary, and this is likely to be added to shortly. One-sixth of the whole Colony is at present Game Reserve under the Act and over the rest of the Colony, with the exception of certain occupied areas immediately behind the tsetse fly cordons, the game laws are in force. Game destruction in the Colony is, in fact, under much better control than was the case before the tsetse fly cordon was completed.

Experience has shown that if an area depleted of game is left alone for a few years, the animals return in numbers comparable with those present before (*e.g.*, Gwaai-Shangani

region, and to a lesser extent the western portion of the Hartley district). Game reduction in a limited area is an elastic measure.

Game destruction on a large scale is certainly highly repugnant, but it is still more repugnant to witness the ruin of settlers and depopulation of country in which civilised man has established a footing. That is the inevitable alternative to the present operations.

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In addition to those given in the text.

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SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 15. February, 1934.

Red Locust (*Nomadacris septemfasciata*).—The egg-laying by belated flying swarms mentioned in my January Report (No. 14) continued at least during the first half of February. By the end of February reports of flying swarms were no longer being received. Occasional solitary fliers have been seen in many parts of the country, being individuals left behind by flying swarms from November onwards. The egg-laying period this season has extended over fully three months, but the later layings have been comparatively insignificant.

The earlier hoppers were mostly in the 5th and 6th stages at the end of the month, while comparatively small numbers from later egg deposits were still hatching. Advanced moulting to the adult form commenced in some areas in the Zambesi Valley at the end of the month.

Thus there were present in the Colony during February old adults, eggs, hoppers in all stages, and newly moulted adults of the new generation.

Damage to Crops.—In some districts the District Controllers of Locust Operations are already satisfied that crops have been saved from the hopper stage. In others native crops have suffered rather severely. Europeans, in general, have been successful in protecting their crops from hoppers, but some considerable damage has been sustained in individual cases.

Damage by the apparently belated flying swarms has occurred to both European and native crops, but has been more or less confined to a few localities in the south-east.

In view of the fact that the locusts will commence to fly about one month earlier this season than last anxiety is felt concerning possible serious damage to maize by flying swarms, as these crops will not in general have matured beyond risk

of damage by the middle of March when the earlier flying swarms are expected to commence moving about.

Enemies. Few reports of enemies were received during the month, but it is likely that most of the later egg deposits were being attacked by *Stomatorhina* and possibly mites. There were no confirmed reports of enemies, parasites or disease in the hoppers, and the only enemies of fliers noted were red mites.

Tropcial Migratory Locust (*L. m. migratorioides*).—Hoppers of this species, unnoticed among swarms of Red Locust hoppers, commenced moulting to the adult stage at the beginning of the month. The new fliers remained, in general, with the hoppers amongst which they had developed, and which were mostly in the 4th and 5th stages. In a few cases, small "swarms" of one or two hundred fliers were seen separated from hoppers, but hopper swarms were invariably found nearby.

Sodium arsenite spray at the usual strength, *i.e.*, 3½ oz. (av.) to 4 gallons water, is reported to kill these adults.

Campaign.—The compaign against hoppers has continued vigorously. A slight reduction in the intensity of operations was possible by the end of the month in some districts, and in one the campaign has been brought to a successful conclusion.

Owing to the inability to obtain further supplies of dry arsenite of soda from the Union of South Africa cattle dip was being issued at the end of the month. This is reported as equally effective, in conformity with experience during past campaigns. One hundred and seventy (170) tons of arsenite of soda have been issued to date in the campaign apart from cattle dip, and at the end of the month seven thousand (7,000) bucket pumps are more or less in action, together with ten (10) handpower barrel sprayers mounted on lorries and five mounted on their own wheels. These large pumps are reported as highly efficient and useful; in fact, one D.C.L.O. estimates that one of these pumps on a lorry is equivalent to about one hundred (100) natives serving small pumps.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

JANUARY, 1934.

AFRICAN COAST FEVER.

No cases occurred.

TRYPANOSOMIASIS.

No cases reported.

HEARTWATER.

Several cases of Heartwater have occurred in Bulawayo and district, being introduced by cattle from the southern areas in which the bont tick is known to be prevalent.

ANTHRAX.

The incontact cattle at Mtoko, referred to in December report, were inoculated. One death occurred in cattle en route from Mtoko to Macheke, the remainder were passed through as free from disease.

HORSESICKNESS.

One death reported in Hartley district.

MALLEIN TEST.

Three horses were tested for Glanders on importation with no reaction.

TUBERCULOSIS.

6 bulls and 25 cows were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls 6, cows 25, horses 3, sheep 702, goats 25 and pigs 15.

EXPORTATIONS.

Bulls 13.

To the United Kingdom *via* Union Ports in cold storage: Pig carcases, 95; beef fore-quarters, 2,340; hind-quarters, 2,703; boned-quarters, 6,918; livers, 23,229 lbs.; tongues, 11,351 lbs.; hearts, 9,761 lbs.; skirts, 2,920 lbs.; shanks, 15,889 lbs.; tails, 4,512 lbs.; kidneys, 1,819 lbs.

Meat products from Liebig's Factory: Beef fat, 77,000 lbs.; tongues, 870 lbs.; meat meal, 99,300 lbs.; meat extract, 16,106 lbs.; beef powder, 28,338 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

FEBRUARY, 1934.

Pressure.—Mean pressure for the month was decidedly below normal, particularly in the East, where Umtali was 1.1 mb below normal.

The main features of the period January and February has been a succession of lows appearing on the north coast of Madagascar and moving down the Mocambique Channel; these lows are associated with south-east winds in Southern Rhodesia and have a bad effect on the rain.

Temperature.—The main temperature of the month was about normal.

Rainfall.—The rainfall amounted to 3.7 inches, or about 1.9 inches below the average for the month. The total since October 1st is 19.8 and the average is 22.5, making a deficiency of 2.7 on the season.

FEBRUARY, 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max	Min	Max.	Min	½ Max Min	Normal	Dry Bulb	Wet Bulb	%	F	0-10	Ins.	Normal	No of Days	
Angus Ranch... ...	...	...	98	63	87.3	68.1	77.7	76.4	75.4	69.3	74	66	...	2.05	4.1	9	...
Beit Bridge	961.4	...	103	62	91.0	69.4	80.2	...	78.1	68.7	62	64	4.5	88	1.6	2	1,510
Bindura...	888.9	..	90	59	82.1	64.1	73.1	..	70.4	65.1	76	62	6.0	5.62	4.5	14	3,709
Bulawayo	867.4	867.7	87	53	80.5	60.7	70.6	70.3	69.0	62.7	71	59	6.5	1.49	4.1	5	4,425
Chipinga	890.0	...	88	58	77.3	62.2	69.7	...	68.5	64.6	83	62	5.5	7.77	8.3	16	3,684
Enkeldoorn	855.7	...	87	53	78.8	59.0	68.9	69.7	68.0	62.4	74	59	5.2	3.54	6.1	8	4,787
Fort Victoria	893.4	894.1	90	52	81.3	62.0	71.6	71.5	70.4	64.8	76	62	5.5	3.94	4.7	10	3,570
Gwaai Siding	901.6	...	93	52	86.8	62.3	74.5	...	72.1	65.8	72	62	4.1	2.61	4.0	11	3,280
Gwanda	904.1	...	92	55	83.0	63.7	73.4	...	71.1	65.2	74	62	5.2	2.27	3.7	8	3,228
Gwelo	860.9	861.7	86	53	79.6	59.5	69.5	70.9	67.9	62.3	74	59	5.3	2.15	5.3	7	4,627
Hartley	884.4	...	88	54	83.0	61.8	72.4	72.3	69.5	65.0	79	63	3.8	3.73	7.3	13	3,878
Inyanga	...	...	...	...	...	...	...	...	..	...	...	...	...	5.15	8.7	17	5,513
Marandellas	836.1	...	81	52	75.5	58.0	66.7	...	65.6	60.4	74	57	6.3	2.38	7.2	10	5,450
Miami	876.7	...	87	59	79.2	62.3	70.7	.	69.2	65.3	82	63	6.6	6.02	4.9	17	4,077
Mount Darwin ...	904.6	...	93	60	83.9	65.2	74.6		73.0	67.4	75	65	5.5	5.64	7.2	13	3,178
Mount Nuza	799.7	...	74	50	65.1	52.7	58.9	...	57.5	56.4	94	55	7.6	7.02	...	16	6,666
Mtoko	875.0	...	93	58	82.2	62.8	72.5	...	70.6	65.0	73	62	4.3	6.61	5.6	16	4,140
New Year's Gift...	...	...	91	60	83.0	64.5	73.8	...	72.3	67.1	76	65	...	2.70	5.0	12	2,690
Nuanetsi	959.0	...	103	59	89.9	67.7	78.8	...	76.5	69.2	69	66	5.8	1.78	2.2	4	1,650
Plumtree	862.4	...	86	54	80.7	61.3	71.0	...	69.7	62.7	68	58	4.8	3.85	4.2	9	4,549
Que Que	879.7	...	89	55	83.6	61.8	72.7	.	70.5	64.5	72	61	5.5	1.42	6.7	7	3,998
Riverbank...	.	...	92	51	85.5	62.8	74.1	73.5	72.1	64.4	67	60	.	1.50	4.5	7	4,090
Rusape...	859.8	...	88	50	78.0	59.2	68.6	...	66.2	62.2	80	60	5.6	5.13	5.4	8	4,630
Salisbury	852.9	853.8	85	51	79.1	59.7	69.4	69.4	68.6	62.7	72	59	6.2	7.73	5.2	11	4,885
Shabani	905.3	...	95	58	83.9	64.6	74.2	..	72.1	65.7	71	62	6.4	86	4.5	7	3,192
Sinoia	885.8	...	89	57	83.3	63.1	73.2	...	71.1	65.4	74	63	4.8	6.39	7.3	14	3,793
Sipililo	...	...	85	60	79.0	62.6	70.8	...	70.1	65.4	79	63	5.0	5.02	8.1	15	3,875
Umtali...	890.7	891.8	91	57	81.7	62.5	72.1	71.5	70.5	65.7	78	63	6.3	2.34	6.1	13	3,670
Wankie	924.1	...	98	64	90.1	69.0	79.6	...	76.4	68.8	69	65	4.1	3.39	4.7	9	2,566

Rainfall in February, 1934, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Total
1	...	...	13	4	58	22	28	29	1	5	...	...	1	...	...	1	...	...	7	3	...	...	...	18	..	...	...	...	190
2	...	...	...	16	110	6	...	...	...	...	...	...	...	11	25	20	...	4	15	28	4	2	...	17	4	4	...	...	266
3	5	...	...	7	314	213	3	...	47	...	...	1	...	20	2	16	..	...	7	72	40	...	...	9	17	4	...	...	777
4	...	...	...	34	46	9	1	12	...	1	25	...	...	...	...	13	...	...	19	6	...	...	...	63	2	...	...	...	231
5	...	...	15	27	69	76	35	4	15	14	9	9	37	...	...	3	...	1	25	...	1	...	...	18	...	...	...	...	358
6	...	10	...	41	38	46	9	40	16	46	7	...	37	54	2	14	...	8	29	...	...	...	...	20	2	11	...	13	443
7	1	5	3	30	59	10	20	10	6	85	1	...	2	...	14	29	3	...	44	7	13	2	...	...	12	2	17	3	378
8	10	...	1	20	17	2	1	186	59	76	35	...	40	26	8	...	2	...	10	1	2	...	...	...	4	2	88	34	624
9	8	3	...	53	2	27	15	72	64	30	4	5	2	12	18	16	99	...	31	1	27	2	...	14	12	7	21	70	615
10	...	..	...	16	8	...	..	7	124	144	5	...	2	42	107	50	...	...	33	21	7	...	...	...	11	4	12	24	617
Mean	2	2	6	25	56	29	17	29	22	30	6	2	11	9	13	13	14	1	22	8	7	1	—	17	5	3	9	13	372

Farming Calendar.

APRIL.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands;

irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 or 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial

control. The spray must hit the insect to kill. Do no re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growh may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Officers Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable from the Poultry Officers.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producing first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

MAY.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions

from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus coddling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted.

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

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LIVE STOCK.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Quota for Chilled Beef.—The British Government is very concerned about the low prices obtained for fat cattle in the United Kingdom. At the end of 1932 it was found necessary to take emergency steps in an endeavour to improve prices by regulating imports. In December, 1933, the price level still continued to be so low that further restrictions on imports were found to be necessary, and early this year the Government of Southern Rhodesia was asked to restrict its exports of chilled beef to the United Kingdom during the period March to June, 1934, to the same amount as was shipped during the corresponding period last year. It appeared evident that the British Government did not realise that shipments were only made from Southern Rhodesia during the latter part of this

period last year. When this was explained a reply was received stating that although the market situation shows no sign of improvement they were prepared to allow us an average of 2,600 cwt. per week until the end of June, before which date the whole question would be again considered.

The Agricultural Marketing Acts of Great Britain.—The following extracts are taken from a speech which was broadcast in Britain by the Rt. Hon. Walter Elliot, M.P., Minister of Agriculture, about a month ago, March 27th. It is felt that they will be of particular interest at the present time, both in connection with recommendations contained in the report of the Economic Enquiry Committee and also the proposed quota for Rhodesian chilled meat on the English market.

"Agriculture, which is still the greatest industry in our land, and, of course, infinitely the most vital, had a surfeit of liberty till it sickened and nearly died of it. Any man was free to grow anything he liked here under any conditions, and any man was free to grow anything he liked anywhere abroad and send it here equally without any conditions. Under these conditions agriculture was not prospering in Great Britain—it was decaying. It was running down. It was about to come to a dead stop. That was, in the nature of things, bound to be so. The average man here, producing the average crop, could not compete, and cannot compete, and will never be able to compete, with the selected man in the whole world-area producing the selected crop in the selected spot, and putting it on the market here at the selected moment. You will see the bearing of this on the problem of spare time of which I spoke a moment ago. It looked as if all the spare time was going to be concentrated in this island so far as agriculture was concerned, and all the work outside. Well, the social organisation simply isn't ready for that. I do not think it will be ready for that, or that it ever should be. But it certainly was not. The immediate facts, at any rate, were not in dispute. The country was being evacuated. In the six years between 1926 and 1932 over one hundred thousand workers left the land.

"It is no use to say that they left the land because of the system of land tenure, and that they would have remained if

they had been put on smallholdings. Neither the smallholder nor anyone else in this country can compete, as I said, with the selected man marketing the selected product at the selected moment from out of the whole world. He cannot, that is to say, if he is to sell enough of what he produces to purchase in turn the ordinary amenities of life—clothes, boots, an occasional visit to the cinema, an occasional 'bus ride to the nearest town such as the other inhabitants of the land enjoy. He could no doubt subsist and ignore competition if he became entirely self-supporting—spun wool from his own sheep, tanned his own sandals from his own ox, and did without slates on his roof or glass in his windows. But such a scheme of life is neither possible nor desirable, and it is odd to find the process advocated by liberal thinkers and others who condemn the process most when applied to larger units such as nations.

"Neither a smallholder nor a large holder could endure permanently on the landslide which the price levels represented within the last three or four years. The liberty to grow anything, and the liberty to buy everywhere, were clearly not working out satisfactorily in practice. The nation as a whole has now accepted, not unwillingly, a limitation upon its power to buy everything everywhere in the cheapest market, in return for a certain security that a reasonable number of the citizens will be able to remain on the land and there produce food, which the nation instinctively felt was a sound thing in itself, and furthermore was a means of avoiding the already intense unemployment in the towns to which these emigrants from the countrysides would only have added. And if we are right in thinking that one of the biggest problems will be the problem of spare time, it is simply vital. Many of us will wish to spend some working time in the country, and we shall all desire to spend some spare time in the country—and not a country simply of playgrounds, but a country where people are doing things—real things. The real thing which people do in the country is to work with flocks and herds, and to cultivate the soil.

"*Organisation Means Voluntary Discipline.*—Now I am not pretending that this is an ideal economic programme. It involves control of imports from abroad, and organisation by the agriculturists at home, and organisation, as has been said,

means a surrender of a certain amount of one's liberty. How great that has been I do not require to tell my fellow agriculturists who may be listening, who know how difficult the tasks set them by the Milk Boards and the Pigs and Bacon Boards have been in recent months. I only say to the rest of the citizens that it has represented an almost unprecedented experiment in voluntary discipline. Whole sections of the community, scores of thousands strong, voted into effect the new law applying to them and only to them.

"The procedure of the Marketing Acts demands that at every stage the producer should have explained to him the proposals which are being made and the sacrifices which are being demanded of him. It is a far more exacting procedure than the passage of a Bill through Parliament. A Marketing Scheme has first of all to be originated by the producers, then it has to be taken up by the responsible Minister; then it has to go to a Public Inquiry presided over by an impartial Chairman, where any member of the public may be heard, or any organisation, and all this hearing must be done in public. Then the Scheme goes to the Minister who brings it, with or without amendments, before Parliament. It has to have a vote in its favour in both Houses of Parliament, and then—and not till then—it goes back to the producers for a final vote. The producers have to vote on the scheme, and printed in the scheme have to be published the names of the men who will administer the scheme, and those affected have to pass it by a two-thirds majority reckoned both by producers and by quantity produced. If it passes that, it is the law of the land. Scheme after scheme in the last twelve months has been able to run the gauntlet of all these checks and balances and come at last into force. Does this not indicate how frightfully men feel the insecurity of economic conditions at the present day?

You may say that the consumers have not voted on these schemes but only the producers, and you may say further that the producers would not have voted for these schemes if they had not been offered a control of imports amounting to agricultural protection. The argument as to the necessary divergence of interest between consumers and producers is the more important, and if it holds good holds against all these schemes and plans.

"It is a question of psychology and not of economics. This clear-cut division between consumers and producers is all wrong. There are not two races of men: one endowed with nothing but a set of jaws to consume, and the other with nothing but a pair of hands to produce. They are the same persons, now appearing in one aspect, now in another. There is the further argument that the consumer's is the essential aspect, since the object of all production is consumption. It is not entirely true when we are getting within sight of the Leisure State to say that the object of all production is consumption, unless you use the word consumption in a very diluted sense. A man does not breathe out and thereby produce carbonic acid gas because there is a use for carbonic acid gas, but because he has breathed in oxygen, and he has done this because he likes to breathe in oxygen and would die if he did not. And the urge to production is no less. A man produces because he likes to produce and because he would die if he did not. That is the real problem and difficulty of the question of unemployment.

"*Economics is a Branch of Applied Psychology.*—Calculations on this subject which begin from economic bases begin wrong, and will end up wrong. It is not, for instance, an accurate calculation which says that we have wasted a thousand million pounds in supporting the unemployed with which we could have accomplished infinitely more in the way of useful work. This question has been looked into again and again, and it has always been found that there is no work that can be suggested which would not have cost three or four times that amount. It is the affront to the people concerned, to the unemployed, that is the serious thing. The psychological affront is in telling 437,000 of our people for over a year that there is nothing on earth that the nation wishes them to do, the affront in telling whole countrysides, such as Durham, or South Wales, or Clydeside, that the nation can see no point in their being awake rather than asleep, strong and fit rather than half alive and in despair, active rather than idle. We have to consider psychology far more than economics, in the problems of to-day; and that, I should say, Blackett, is where I join issue with you, with you and your friends the physicists, and with you and your friends the mathematicians.

Economics is not a branch of statistics; it is a branch of applied psychology. It is just at that point that government leaves off and leadership begins.

"In government, straight government, no doubt it would be an advantage if all the world were run from one centre with one great set of files, with indexes and typewriters and telegraphs and dictaphones all clicketting away and settling every five years how all the world was to be ordered for five years to come. But we have waited too long for that dream to be born, and indeed it will never be born, never in our time, never for thousands of years to come. Furthermore, even as a dream, it is to the average man a dream lacking in beauty. In fact, it is a nightmare, and it becomes more and more an unnecessary nightmare. We have to organise our own communities, and look at our own back-doors for the solutions to our problems. The world is too vast and too diversified to get into the straitjacket of a single international plan. What is more, scientists every day make the units more self-contained instead of less self-contained, and make it not only less advisable but less possible for this country or for any country to obtain prosperity by putting all that it makes on wheels and running it off to the ends of the earth.

"It is the march of science which is producing the phenomenon loosely called economic nationalism. It is folly to speak of the home development which this implies, as 'taking in one another's washing'. Taking in each other's washing is the process by which we all live on this planet. We do not import or export from the moon or to the fixed stars. The Western countries will have to solve in the future far more of their own problems at home than they have done for the last hundred years. We delude ourselves if we say that we should recover if we could only open up the Russian market or the China market or the other markets which are so often dangled before our noses. To open up a new country nowadays is to open up not only a consuming but also a producing area, to open up not a sink but a waterspout, and a waterspout producing often the very commodities which we had hoped to supply. Home development will be inevitably one of the key-notes of the age immediately before us. But it will have to be, not in order to grow rich, but in order to live fully and

reasonably. Agriculture is the first industry which has grasped the necessity of economic self-discipline, economic self-government, if this change is to be secured. The nation as a whole is only beginning to grasp this necessity, but it is grasping it successfully. It will thereafter have to grapple with the still more exacting task of psychological self-discipline when it attempts to utilise the spare time, the leisure, which I think this further development will demand.

"*Leaders Cannot be Obtained by Hatred.*—Can these great changes be put through by the haphazard methods which we have seen in the past few generations? I think not. I think they will demand the understanding and agreement of all, and the close and unremitting direction of people who are trained both in the immense stores of knowledge, and the scientific method, of the new thought, and who can join to them the ordinary human touch, the touch of decency, the touch of idealism, the touch of comradeship, which, as I say, is where government leaves off and leadership begins. If you ask me how these men are to be obtained, I would say that the task and the opportunity will call them out. That, at least, has been our experience in agriculture. And I will tell you how they are not to be obtained. They are not to be obtained —not, at least, in our country—by mutual hatred. They are not to be obtained by sudden convulsions involving a break with all our tradition and all our continuity.

"We are tackling the questions of to-day with no violent change of policy such as it would seem has been necessary in the United States. We have tackled them with no violent revolution, such as apparently was found necessary in Germany or in Russia. Yet I think we have got as far along the road as any of those three. The great problem in our changing times is whether we can keep the pace of adaptation quick enough to keep abreast of changing circumstances. We are only just beginning to see how great an effort this will demand. Yet we have the stuff to draw upon, both material and moral, as good as ever we have had before—better, far better than we deserve. The heart of the nation is still high; its courage and resource are unabated. What we did yesterday we can do again; and to-morrow is also a day."

London Quarantine Station for Pedigree Stock for Export.—Arrangements after 31st March, 1934.—The London Quarantine Station at the East India Dock, which was established in 1928 in order to safeguard the Dominions and Colonies importing pedigree cattle, sheep, goats or swine from the United Kingdom from the risk of the conveyance of foot-and-mouth disease, has been maintained in part by fees paid by the exporters, and the annual deficit on the working has been met from the Empire Marketing Fund. This fund having ceased to exist, representatives of the Breed Societies interested were invited to confer with representatives of the Royal Agricultural Society of England and the Ministry in order to devise means whereby the Station could be continued on a more self-supporting basis. At a conference held on the 9th January, 1934, certain recommendations were agreed upon and have since been approved by H.M. Government.

These recommendations include the transfer of the administration of the Station from the Royal Agricultural Society of England to the Ministry as from 1st April, 1934, and also certain increases in the fees charged in respect of animals entering the Station. The fees after the 31st March, 1934, will be (for the normal quarantine period of 14 days) as follows:—

General Fee—

For single animals:—

Cattle ...	£6	15	0
Pigs ...	4	0	0
Sheep or goats ...	3	10	0

For each additional animal from the same premises of origin:—

Cattle ...	£4	5	0
Pigs ...	1	10	0
Sheep or goats ...	1	0	0

***Fee for animals of high value*—**

An additional charge (per animal) of 2 per cent. of the insured value will be made for cattle valued at £100 or over, of 1 per cent. for pigs valued at £40 or over, and of 1 per cent. for sheep and goats valued

at £30 or over, subject to a maximum additional charge of £10 per head for cattle, and £1 for pigs, sheep or goats.

Charges for periods in excess of 14 *days.*

If animals are detained for a longer period than 14 days, there will be a charge, for each day in excess of 14 days, of 7s. per head for cattle, 2s. 6d. per head for pigs, and 1s. 6d. per head for sheep or goats.

Transport from Quarantine Station to Vessel.

The charge in respect of the transfer of the animals from the Station to the exporting vessel will remain as at present, *i.e.*, 5s. per head for cattle and pigs, and 2s. 6d. per head for sheep and goats.

The arrangements for the veterinary examination and certification of animals in accordance with the provisions of the Quarantine Stations (Regulations) Order of 1928 have always been under the direct control of the Ministry, and there will be no change in the requirements in this connection.

The Export of Frozen Porkers
TO THE UNITED KINGDOM.

By A. E. Romyn and C. A. Murray.

The first consignment of frozen pork from Southern Rhodesia was despatched to the United Kingdom in February of this year.

Objects—The object of this experimental shipment was to determine whether:—

1. The better type of porker raised in this Colony would be suitable for the English frozen pork trade.
2. The feeds commonly available in this Colony would produce a carcase of desirable cutting and cooking qualities.
3. The existing slaughter and transport facilities were satisfactory for an export trade.

Pigs Selected.—Approximately 100 pigs were selected from the herds of eight different farmers. The pigs were selected as weaners and were typical of about thirty per cent. of the best pigs shipped to-day to local factories. They were finished on the farm and shipped, approximately two months later, to the factory when ranging from 80—120 lbs. in live weight. The average weight per pig for the whole consignment was 100 lbs. 97 pigs were actually railed to the factory. Two were rejected, one for lack of finish (fig. 2), one for excessive wrinkles, and 95 were exported.

There was a shortage of maize at the time the experiment was started and the consequent scarcity of pigs made the selection more difficult than it would normally have been. On account of the shortage of feed the weaners on the whole had not been well done and the age at the marketing varied from four months to nearly six months.

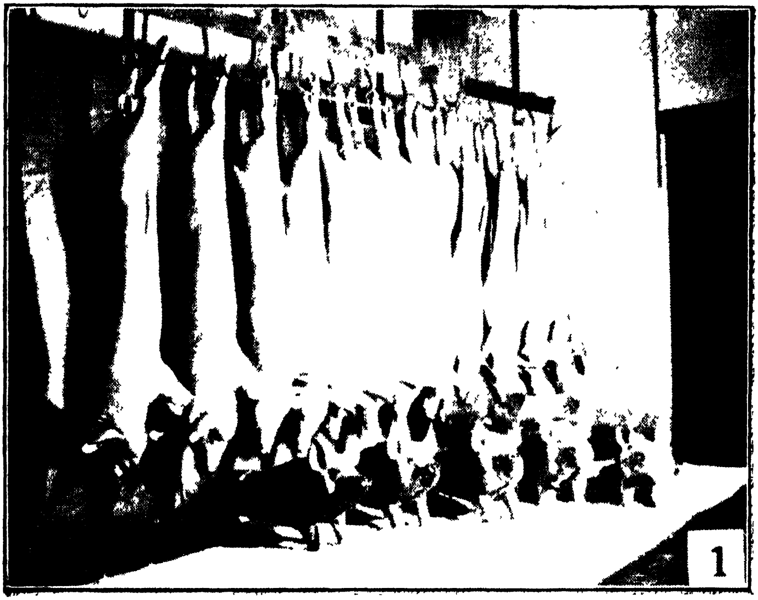

Fig. 1. Lot A.- Frozen Porkers. Fig 2 – Unfinished Pig, rejected.
Fig 3. Lot A.—Selected Porkers.

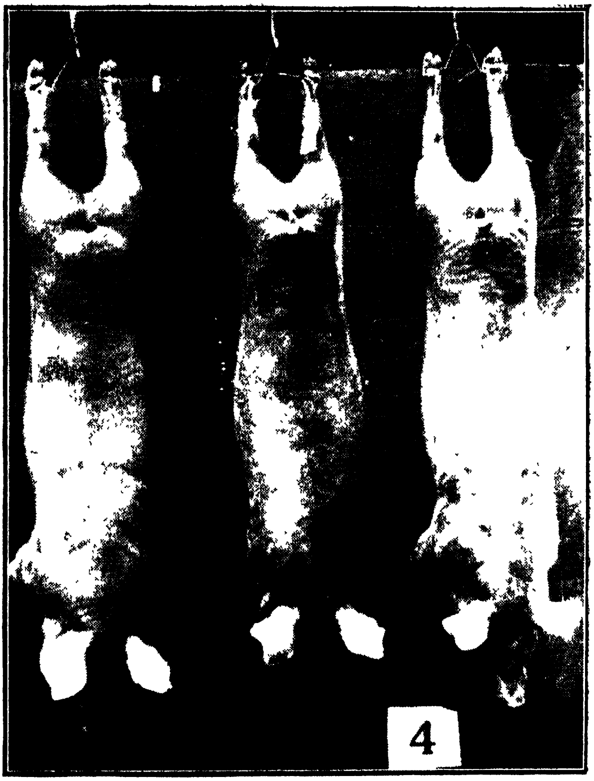

Fig. 4 Lot D Heavy Porkers, rather too fat

Fig. 5. Lot E. Large Black Porkers.

Fig. 6. Lot F. Large White X Large Black Porkers.

The pigs selected were of the following breeds or crosses:

Large White X Large Black,
Large Black,
Berkshire X Large Black,
Middle White X Large Black.

The sows were Large Blacks and the boars represented the breeds most likely to be used for the breeding of porkers for export. The system of feeding was laid down by the Department of Agriculture and followed as closely as possible by the co-operators.

The pigs received maize as practically the sole grain ration supplemented by bloodmeal or meatmeal where separated milk was not available in sufficient quantities to balance the ration. Various green feeds were fed in addition. In several cases the succulent feed happened to be lucerne. No purchased feeds were used other than bloodmeal or meatmeal. Over half the pigs received no separated milk.

In most cases the weaners had not received a balanced ration before the start of the experiment and the rate of gain after the addition of bloodmeal or meatmeal was considerably faster than was anticipated by the feeders. Some pigs were consequently marketed at heavier weights than those laid down (80—100 lbs. liveweight) and a group of heavier porkers (Lot D, fig. 4) had to be made in the consignment to take these pigs. The average dressed weight of these heavier pigs was 87 lbs. as compared with the dressed weight of 60—80 lbs. most in demand at Smithfield.

The refractive indices of the back fat of the various lots and the New Zealand pigs, referred to in the next section, was determined to compare the hardness of the fat and, if possible, to demonstrate any effect of the feeding.

The New Zealand pigs appeared to show up slightly harder than the Rhodesian pigs, but the results are not considered significant under the conditions obtaining. No significant difference was apparent between the various lots of local pigs. The only difference noticed was that the pigs receiving separated milk were, on an average, marketed younger than those which did not receive milk.

Preparation.—The pigs were slaughtered and frozen at the works of the Rhodesian Export and Cold Storage Company in close co-operation with the Department of Agriculture.

Three frozen New Zealand porker carcases had previously been shipped in cold storage from Smithfield to Bulawayo and were used as models in the dressing and prepartion of these porkers. No great difficulty was experienced in the preparation, though it was not possible to get the really smooth finish on most of the Rhodesian carcases that was shown by the New Zealand models. The throat glands were not correctly displayed in all cases.

Some white pigs showed evidence of sun scald after preparation and a few showed scratches, the result of damage caused by loose ends of wire on the pig crates or by fighting in the railway trucks. On the whole, however, the consignment made a very attractive showing when finished, and it would have been difficult for a layman to distinguish the New Zealand carcases when mixed with the others.

Grading.— After slaughter each pig was separately numbered, measured and described.

Some of the farm lots showed considerable lack of uniformity within the group and it was decided therefore to grade the whole consignment into definite types independent of ownership for purposes of sale. The individual numbers were, however, preserved for purposes of report.

The description of each sale lot is given in a subsequent section of the report.

Shipment.—No difficulties were experienced in the transport and marketing of the pigs. Arrangements throughout were made by the Rhodesian Export and Cold Storage Company. The porkers were shipped to Capetown in one of the mechanical refrigerator trucks and arrived in excellent condition, though the flesh temperatures showed some rise in transit. They were consigned to the Stock Breeders' Meat Co., Ltd., Smithfield, for sale. This is the company which distributes Rhodesian chilled beef.

London Reports.—Reports on the pigs were obtained from the Stock Breeders' Meat Co., Ltd., and the London office of the Imperial Cold Storage Co., Limited, officials connected with the Smithfield Market and the Meat Industry generally, and from buyers.

The reports from all these sources are in agreement and very promising.

The following is a brief summary of the reports from the Stock Breeders' Meat Co., and the Imperial Cold Storage Co.:—

"The pigs were of a type which is very suitable for the United Kingdom trade and would at all times meet a ready demand and compare most favourably with New Zealand and Australian pigs.

"A few carcases were scratched with a red weal mark, this we appreciate could easily have been done when they were shipped alive to Bulawayo and could be guarded against in the future. There were also some reddish patches caused through sun scald, and no doubt this would also be obviated if possible.

"Respecting the black pigs which were included to test their suitability in regard to colour, we consider that colour does have some bearing on sale value on this side. The white pig naturally looks a better finished article and has a better appearance in the skin, but we appreciate that in a hot country like Southern Rhodesia it may be easier and more profitable to raise the black hog as against white owing to the sun scald. The prejudice against the black pig is stronger in London, perhaps to the extent of ½d. per lb., but they sell without any discount in the North of England.

"The pigs cut well. The flesh had a nice colour and showed up particularly bright and new. Every butcher who used the pigs has been quite satisfied with them and has come back for more."

The other reports are in the same vein. Colonel T. D. Dunlop Young, as Chief Veterinary Inspector at Smithfield, stated that "the carcases were very good, some of them equal to New Zealand pigs." The Chief Meat Grader at Smithfield

described the porkers "as good pigs, which would find a ready sale." Some of the carcases might be on the fat side, but he considered that the Rhodesian frozen porkers compared very favourably with any on the Smithfield market. B. Forsyth, Esq., Commercial Representative, United Kingdom, New Zealand Meat Producers' Board, considered them "a very good lot of pigs showing correct breeding and feeding," and that the butchering and preparation of the carcases was excellent. Such porkers, he stated, "should always find a ready sale on Smithfield."

The largest buyer was H. Wright, Esq., M.B.E., J.P., Chelmsford, who purchased 25 pigs and stated they proved wonderful cutters. He reported that the pigs were the right size, the meat was fine in texture and cut beautifully. "Rhodesian producers can be assured," he said, "that pigs of this quality would command a ready sale at Smithfield at top prices."

Individual Reports and Prices.—As previously noted the pigs were graded into different lots for sale, each group typical of a type of porker produced now in commercial quantities in this Colony.

In the succeeding paragraphs of this section the Rhodesian description is given first followed by a description of the breed or cross, the dressed weights of the pigs and the report of Stock Breeders' Meat Company, Smithfield.

Lot A (figs. 1 and 3) 18 typical porker carcases of mixed breeds.—Excellent quality, all white.

8 Middle White X Large Black.

10 Large White X Large Black.

Average cold dressed weight 71 lbs.

Gross sale price realised per lb., 5.99d.

Stock Breeders' Meat Company report.—"Practically ideal butcher pigs. If our friends could always aim at shipping pigs similar to Lot A, they can rest assured that Southern Rhodesian pigs in due course will make as much money as any frozen pigs coming to the United Kingdom market."

Lot B, 23 typical baconer pigs at porker weights.—Long carcases, rather lacking in finish. Mixed colour.

8 Berkshire X Large Blacks.
15 Large White X Large Black.

Average cold dressed weight 77 lbs.
Gross price realised 5.56d. per lb.

Stock Breeders' Meat Company report: "A good parcel, but will probably cut out somewhat deficient in lean meat."

Lot C, 25 bacon carcases at porker weights.—Rather fatter than Lot B, but not so uniform and including more black pigs.

5 Large White X Large Black.
20 Berkshire or Middle White X Large Black.

Average cold dressed weight 73 lbs.
Gross price realised 5.68d. per lb.

Stock Breeders' Meat Company report: "Exceptionally good parcel. Some of the Berkshire crosses had not been so well dehaired as the others. Some black pigs were, however, so well scalded that it would hardly be noted that they were black pigs."

Lot D (fig. 4), 13 heavy, rather fat porker carcases.—Overweight. Some showing sun scald and superficial bruises.

13 Large White X Large Blacks.

Average cold dressed weight 87 lbs.
Gross price realised 5.70d. per lb.

Stock Breeders' Meat Company report: "A few carcases were slightly on the fat side, but this was in some measure due to the fact that they were heavier carcases. Also a few pigs showed signs of sun scald which deteriorated their appearance slightly."

Lot E (fig. 5) 7 typical pure bred Large Black carcases.—Rather tapering in the ham.

Average cold dressed weight 83 lbs.
Price realised 5.73d. per lb.

Stock Breeders' Meat Company's report: "A good parcel of pigs and especially good butcher's meat considering the weight. The carcases did not have quite the finished appearance of Lot A owing to their being black pigs."

Lot F (fig. 6), 9 typical Large White X Large Black carcases.—Long. Fairly well finished.

Average cold dressed weight 80 lbs.

Gross price realised 6.0d. per lb.

Stock Breeders' Meat Company's report: "A very good parcel of butcher pigs."

General.—The reports and prices are better than were generally anticipated. At the time of shipment it was thought that Lot A (selected) would sell at a premium over Lot F (typical Large White X Large Black cross). The two lots, however, sold at practically the same price. No unfavourable comments were made in regard to age or firmness of fat of any of the Lots.

Returns.—The gross sale price realised for the consignment was 5.73d. per lb. The pigs were exported by the Rhodesian Export and Cold Storage Company at an agreed "all in cost" of 2d. per lb. The net return to the exporters at Bulawayo is therefore 3.73d. per lb.

It is impossible to work out representative costs on such a small shipment but, on the basis of returns secured for the consignment, the Company estimates that porkers of this quality should be worth approximately 4d. per lb. dressed weight at Bulawayo.

Summary.—Taking the conservative view, the reports indicate that:—

(1) The better type of porkers produced locally are quite suitable for the United Kingdom trade. In this particular shipment the best price was obtained for the Large White X Large Black cross, which is the one usually recommended in the Colony.

(2) White pigs are preferable to black pigs, but the latter can be disposed of satisfactorily if carefully prepared and of good quality.

(3) It is possible to produce suitable porkers on farm grown feeds with the addition only of bloodmeal or meatmeal where separated milk is not available in adequate quantities.

(4) Frozen porkers can be shipped in very good condition from this Colony to Great Britain.

General.—Depending upon quality New Zealand frozen porkers sold at from 5⅛d. to 6d. per lb. at the time this consignment was disposed of. The Rhodesian pigs therefore sold at a premium on the general run of the New Zealand porkers. The agents, however, point out that the prices realised on such a small shipment cannot be taken as representative of the true value of the porkers and state that, on the basis of present price levels, a fair estimate of value for large quantities of pigs of the quality shipped would be 5½d. per lb. *ex* store.

Despite these favourable reports the prices realised will probably not be considered satisfactory by most local producers who are accustomed to higher values for the quality of pig exported.

In relation to New Zealand prices they are, however, extremely satisfactory. A comparatively small rise in the market combined with some economy in the cost of production and marketing should make them profitable to farmers in this Colony. It is proposed, therefore, to make two or three larger consignments on similar lines towards the end of this year. If the results are as satisfactory, the information will be available on which to base a definite policy for expansion of the pig industry, which should be of far greater importance in this Colony than it is at present.

Acknowledgements.—The acknowledgements of the Department of Agriculture are especially due to the Rhodesian Export and Cold Storage Co., Bulawayo, and the Stock Breeders' Meat Co., Ltd., Smithfield, for the care and interest taken in the preparation and marketing of the consignment and to the eight farmers named below who co-operated in the experiment:—

Bickle Bros., Bulawayo; Lieut.-Col. G. G. Carpenter, Glendale; H. P. Fynn, Bembesi; R. H. Kirkman, Salisbury; G. H. Rorke, Bulawayo; C. Tompsett, Que Que; Colin West, Lancaster; B. L. Whyte, Fort Rixon.

Saltbush: A Winter Succulent for Sheep IN MATABELELAND.

By D. G. HAYLETT, M.Sc., Ph.D.,
Director, Matopo School of Agriculture.

The rainfall in Matabeleland is confined to a few summer months. In winter the veld is dry and the feeding value of the grazing is extremely low. This fact is generally appreciated by the farmer who conserves dry fodder such as veld hay and maize stalks for use during the winter months. For ordinary purposes this will suffice, but for certain classes of stock it is inadequate. Dairy cows, for instance, require in addition, both concentrates and succulents.

In the case of sheep it is considered advisable that they should lamb down in April, May and June.(1) During the latter part of the lambing season there is generally a lack of succulence in the natural grazing and some form of supplementary feeding is necessary to overcome this deficiency. The succulence is particularly useful at this time in insuring that the ewe will have adequate milk with which to raise the lamb. Besides assisting in the general assimilation of dry fodder, succulents have a laxative action which tends to loosen the compacted mass of dry grass during the process of digestion and so assist in overcoming the toxic effects of worm infestation. The saltbush is a succulent fodder which is particularly useful in this connection.

Description and Adaptability.—Saltbush (*Antriplex num mularia*), also known as OLD MAN SALTBUSH, has been introduced in the Union of South Africa, where it is now being used to a considerable extent as a feed for cattle, and particularly sheep. The advantages of saltbush in a summer rainfall area are that it remains green during the winter months, is relatively frost resistant, drought resistant, and

(1) Murray, C. A.—The Blackhead Persian (Dep. Agr., Salisbury). Bull. 907, pp. 1-12, Dec., 1933.

Fig. 1. Saltbush seedlings ready for transplanting.
Fig. 2. Typical growth after first winter.
Fig. 3. Saltbush at Matopos. The staff is 7 feet high.
Fig. 4. Saltbush after grazing by sheep.

Fig 1. Sheep grazing on Saltbush

Fig. 2. A young plantation after transplanting.

brak resistant and produces a good supplementary succulent feed at a time when such feeds are most needed. It has the additional advantage of being a permanent crop.

Reports from the Salisbury Experiment Station(1) indicate that saltbush has not proved successful under the more humid conditions pertaining in Mashonaland and is, therefore, not being recommended in that area. At the Matopo School of Agriculture the crop has made satisfactory growth. This suggests that saltbush is well worth a trial in other parts of Matabeleland under similar conditions.

Old Man Saltbush is an erect perennial reaching to a height of 4-8 feet in 4 years.

The plant may be propagated with ease from seed or by means of cuttings. When grown from seed the young seedlings send out a tap-root. A plant established from a cutting develops only fibrous adventitious roots and no tap-root.

The saltbush has grown well on a black maize soil at the Matopo School of Agriculture. Owing to its having a tap-root system it will probably not make satisfactory growth on shallow soils with an impervious sub-soil.

A number of growth measurements have been recorded which indicate that the growth-rate under Matabeleland conditions is similar to that in areas where its usefulness has been proved. A summary of the growth measurements is given in Table 1.

*TABLE 1.—*Growth Measurements of Saltbush Plants Grown at the Matopo School of Agriculture.*

	Shallow Soil.	Deep Soil.
Number of Plants Measured ...	64	64
Average Height	3ft. 2in.	3ft. 5in.
Maximum Height	4ft. 10in.	4ft. 10in.
Minimum Height	1ft. 4in.	1ft. 9in.
Average Circumference	4ft. 5in.	5ft. 5in.
Maximum Circumference ...	7ft. 8in.	8ft. 8in.
Minimum Circumference... ...	0ft. 8in.	2ft. 9in.

(1) Mundy, H.G.—Twenty-one Years of Plant Introduction. *Rho. Agr. Jour.* XXIX., No. 8, p. 612, Aug., 1932.

*Seed planted July, 1931; seedlings transplated March, 7th, 1932; measurements taken December 8th, 1932.

The plantation was established late in the season (March). It would have been better had it been established in December or January. However, the plants continued growth throughout the first winter without any artificial watering and before the first rains has set in the average height was nearly 3½ feet. From the time of planting until the beginning of set in rains (*i.e.*, during the dry season) the total precipitation was only 0.89 inches. This winter growth may be considered satisfactory.

During the rainy season the rate of growth is much more rapid than during winter. An idea of the luxuriant growth which has taken place to date may be gathered from the accompanying Plates.

Establishment.—Although it is possible to establish a salt-bush plantation from cuttings taken in August it is advisable, nevertheless, to start the crop from seed. As stated previously this is due to the absence of a tap-root in plants established from cuttings.

Seed should be sown in well prepared seed-beds in the vicinity of a water supply, or in tins. Half paraffin tins cut longitudenally, with holes punched in the bottom for drainage, and filled with good nursery soil are satisfactory. The seed should be planted in July or August. After about 6 months, if the growth is satisfactory, the seedlings may be transplanted into the permanent site. Plants suitable for transplanting should not be too small; about 12-18 inches high as shown are a good size. Seeds planted in July should produce seedlings of this height for transplanting in December to January. There is no harm in keeping the seedlings over until the following year if satisfactory growth is not obtained in 6 months.

As the crop is to be grazed *in situ* by sheep the plantation-site should be selected with due regard to convenience. Any good deep maize soil should be satisfactory. The land should be ploughed deep and any clods well broken down during the early part of the rainy season. The land should be kept free of weeds by harrowing and re-ploughing if necessary. At the time of planting the land should be in good tilth.

The young seedlings should be set out in rows 6 feet apart with the plants spaced 3 feet in the row. Transplanting should take place after the rains have set in (December to January) and the operation should be carried out during a shower if possible. Care should be exercised in setting out the seedlings to insure that the tap-root is not bent double. Should a drought period follow setting out, the plants should be watered artificially if this is at all possible.

It should be remembered that although salt-bush is classed as a drought-resistant fodder, it will respond well to an occasional application of water if available. If the plantation is to be established in a paddock supplied with a well, dam or windmill, it may be practicable to locate it near the water supply and to give it an occasional light watering during the dry season. The plants will respond well to this treatment, but it is not an essential.

About 2,500 plants will be required to establish an acre at an espacement of 3 feet by 6 feet. One pound of seed will produce about 5,000 seedlings, or enough for a two-acre plantation.

Utilization.—Saltbush is harvested by the animals themselves (Plate III.). The plantation should not be grazed during the first winter after planting nor too heavily until the plants have become well established and have made adequate growth.

The most satisfactory method is to allow sheep to graze for a few hours daily. A little observation will enable one to judge when the plants are likely to suffer from over-grazing.

The purpose of feeding saltbush is to supply winter succulence and the animals should not be expected to exist entirely on the feed. For best results, in addition to a daily period of grazing on saltbush, sheep should receive some supplementary feed.(1)

Saltbush is, however, not without a certain amount of feeding value as the following data will show:—

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(1) *loc. cit.*

TABLE 2.—(After Turpin and Gill ([a])).—*Pounds of Dry Material and Digestible Nutrients per* 100 *lb. of the Crop.*

Feed.	Dry Material.	Dig. Protein.	Dig. Carbo-hydrate.	Dig. Fat.
Lucerne hay	91.4	10.6	39.0	0.9
Cactus	10.4	0.4	5.8	0.1
Saltbush...	23.3	2.8	5.9	0.2
Maize silage	26.3	1.1	15.0	0.7
Wheat (grazed) ...	27.4	2.8	15.1	0.6

SUMMARY.

(1) A saltbush plantation established at the Matopo School of Agriculture in 1932 has made satisfactory growth which is about normal.

(2) It is recommended that the crop be tried under similar conditions in Matabeleland as a winter succulent for lambing ewes.

(3) The crop might be tried on any good maize soil, but preferably one of good depth.

(4) The crop should be grown from seed sown in seed-beds or tins in July or August and transplanted to the permanent site in December or January after the plants have reached a height of 12 to 18 inches.

(5) The plantation should not be grazed during the first winter after establishment.

NOTE.

The writer is not aware of seed being available in Rhodesia. It may be obtained at a small cost from Forestry Department, Pretoria, Union of South Africa.

([a]) Turpin, H. W., and Gill, G. A.—Insurance Against Drought. Bull. 36. Department of Agriculture, Union of South Africa, pp. 1—62 (1928).

Animal Husbandry Problems in Northern Nigeria.

Technical Communication No. 4 of the Imperial Bureau of Animal Nutrition, dealing with Animal Husbandry problems in Northern Nigeria, is of particular interest to use because it is recognised that in regard to this subject at least Africa has its own particular problems, which may vary from place to place but are yet African. For instance, it is recognised that the problem of the natural pastures is probably the one of most vital importance in African pastoral agriculture, and the similarity of Nigerian conditions to our own is most striking. In the foreword to this report the Director of Agriculture points out that—

That in many of the grasses, when they have shed their seed, the fibre content is so high, and the soluble carbohydrate, ether extract, and protein content so low, that the net energy value of such old grass, even of the best species, is extremely low, even if we assume a normal digestibility and neglect the energy used in walking which the grazing entails.

There are several species of grass which are largely eaten by cattle; and as we have been studying these grasses agriculturally and chemically only for less than two years, we have still more to learn about them. But it needs little study to see that most, though not all, of the edible grasses are in seed by the end of July. The grazing animal does not, indeed cannot, pick out only such small quantities of young leaves as may be present on such ripe grass. Thus, while the grazing from April to July may be regarded as more or less comparable to ordinary grazing in a more humid climate, and from August onwards to October the Nigerian animal is eating an increasingly dry and dead fodder, of high fibre content, mixed with decreasing proportions of green grass. After that for five months the animals are living on grazing which, except for the small amount of re-growth in January, consists entirely of dead mature stems and leaves, with a very high fibre content. Such grazing would seem barely comparable even with the

dead "long pulling" in the worst patches of an English pasture in winter. Even assuming a normal digestibility of the food, such a diet can have but little net energy value. With such a diet, in the absence of any green or fermentable food, it is even possible that the digestibility is not normal.

The cattle of Northern Nigeria belong to a slow maturing breed. They grow slowly, take three or even four years to reach sexual maturity and their milk yield is low. The reproductive rate is slow, with an average interval of eighteen months between calvings.

Field observations suggested that this low level of productivity might be associated with a quantitative deficiency of food, since there is an actual shortage of pasture during the greater part of the dry season.

The following extracts from the summary of Part II. indicate the main results of the experiments—

1. Feeding concentrates yielding approximately 2 lbs. of starch equivalent resulted in a 100 per cent. increase in weight and a lowering of the age at which sexual maturity was reached.

2. The effect of raising the protein content of the ration was evident only during the season when the nitrogen content of the natural pastures was lowest.

3. Feeding steamed bone flour and sodium chloride did not influence the weight increase, age of reaching sexual maturity, or general condition.

4. It has been shown that the inorganic phosphorous and calcium content of the blood of Nigerian cattle fall within normal limits, but that the former can be raised by feeding bone flour.

Part III. deals with a form of pica which is prevalent if the cattle are not supplied with one or other of the native salts sold on the markets in Northern Nigeria. The best known and most generally used of these native salts is called Kanwa, and is rich in sodium.

The richest owners allow their cattle free access to kanwa for twenty-four to forty-eight hours, as often as they can afford, with a minimum interval between feeds of about

fourteen days. With others not so well off the intervals may vary from one to six months, according to their ability to buy kanwa. All were agreed that if kanwa was withheld over a long period the cattle developed uneasiness, would not settle down to graze and would lick earth. Some stated that they would lose condition, and in extreme cases fail to breed.

The opinion was universal that common salt (sodium chloride) would keep the cattle well during the dry season but that it was more or less useless during the wet season. In this connection it is interesting to note that imported salt is cheaper than the native salts, but the owners will use the former only when compelled to do so by poverty.

Some of the cattlemen laid special stress on the beneficial purgative efforts of the native salts. Herd-owners in the Gadabawa district reported that their cattle would almost live in a chalk pit when they were showing pica, but the pica would continue until kanwa was supplied.

When an owner finds that his cattle are discontented and licking earth he supplies one or other of the native salts. If then he finds that some of the cattle refuse to eat kanwa or having eaten still continue to lick earth, he concludes that they are suffering from "mudu," a disease associated with trypanosomiasis. It seems probable, however, that this "mudu" pica is not closely related to the "normal" pica under discussion here. When an owner takes his "mudu" cattle to a veterinary camp and they are treated with intravenous injections of tartar emetic, the cattle have, in his opinion, been cured because the medicine has enabled them to eat kanwa again.

From the summary it appears:—

1. Pica can be controlled by supplying sodium in the form of a simple salt, sodium carbonate.

2. The pica is not associated with a calcium or phosphorous deficiency in the diet.

3. The metabolism of phosphorus, calcium and chlorine, appears to be normal whether sodium is supplied or not.

Part IV. deals with the general problems met with and the observations in regard to the improvement of native cattle are of exceptional interest.

The cattle are of the Zebu type and appear to be similar in conformation, growth and rate of reproduction to the ordinary native cattle in this Colony.

It has been noted in the herds studied that, though cows calve on an average once in eighteen months, they can be roughly divided into annual calvers and biennial calvers, and that they continue as such throughout their reproductive lifetime. In addition to this peculiarity it is known that there is a negative correlation between milk yield and frequency of calving. In other words, the annual calvers are "poor" milkers and the biennial calvers are "good" milkers. These traits are inherited independently of the feed supply, though influenced to a certain extent by extremes in the amount of feed available.

Profiting by this knowledge the native Fulani herdsman, who is a good stockman considering his environment, breeds definitely either for number of cattle or milk yield, depending on his particular circumstances. Where milk yield is the primary consideration he selects a short-legged calf from a "heavy" yielding cow for his stock bull, and where milk is not so important, he uses a similar bull from an annual calver.

In the course of time a very homozyzous (pure) type of cattle has been evolved, which is much hardier than the imported breeds and well adapted to the environment, particularly in regard to its low requirements for drinking water, which is a very valuable asset.

In one case where a red poll bull was used by the Emir of Katsina, 35 calves were sired only two of which survived, and these were not in any way superior to the native stock. However; "superior" this red poll bull may have been in England, it is obvious the same adjective cannot be applied in Nigeria.

Under the circumstances supplementary feeding is not an economical practice, and for the time being the line of improvement suggested is to breed for combined moderate milk yield and annual calving. From the records of two cows in the experimental herd it is thought that in time it may be possible to combine these two characters. The author appears to doubt, however, whether the amount of improvement likely to occur would justify the trouble.

His deductions are summed in the following paragraph:—

Quality, as it is generally understood, is valueless in Nigeria from a beef point of view. The demand is for cheap bulk, so that time spent in trying to improve the beef qualities, even if this were economically possible, would be largely wasted. Until such time as the investigations into the problems of the food and water supply have been brought to a successful conclusion and so long as the economics of production remain as at present, a "superior" bull must be defined as one genetically pure for moderate milk yield and for regular annual calving. If the physiological and economical limiting factors cannot be thoroughly investigated and removed it will require serious consideration whether expenditure on trying to evolve an animal of so low a standard of superiority can be justified in view of the standard achieved already by the best natives themselves.

Myiasis (Screw-Worm) in Cattle
IN SOUTHERN RHODESIA.

By D. A. LAWRENCE, Director of Veterinary Research,

and A. CUTHBERTSON, Entomologist.

Introduction.—Two papers by one of us (A.C.) have recently appeared* in this Journal on the subject of "Myiasis" or "Screw-worm."

In these have been discussed the meaning of the term myiasis (infestation of living animal tissues by *Dipterous larvæ* or "maggots"), the predisposing causes of infestation, methods of control and treatment and the life history of the fly responsible for myiasis in this country (*Chrysomyia bezziana*).

Myiasis is, however, of such economic importance, especially in cattle under ranching conditions, that a further article on the subject, dealing mainly with the condition as considered from the veterinary standpoint, will not be superfluous.

As indicated in the February *Rhodesia Agricultural Journal*, the occurrence of myiasis due to *Chr. bezziana* was first recorded in Southern Rhodesia in 1917, and since that time it may confidently be stated that this disease or condition has become progressively more serious, until of recent years its economic importance has been such as to attract the attention of cattle owners, especially ranchers, in many and widely separated parts of the country.

Research was therefore directed towards the finding of a suitable weak link in the biology of the fly with a view to reducing and controlling the incidence of the condition which it produces. This research, conducted mainly on Glass Block Ranch, near Balla Balla, has provided information of con-

*R.A.J., Vol. XXXI., No. 2, pp. 100-111, and No. 4, pp. 256-258 (1934).

siderable interest, but, unfortunately, as yet no means has been found to adapt the knowledge thus obtained to any sure and practicable method of eradicating myiasis.

Incidence of Myiasis.—From information previously available, and from statements kindly obtained recently by the Chief Veterinary Surgeon from his officers distributed throughout the Colony, it may be stated that myiasis occurs at any time of the year, but is most prevalent during the warm rainy season, *i.e.*, during a period which is particularly favourable for the development of the Screw-worm Fly and of ticks. It would also appear that the condition is most common in thickly bushed country and low-lying valleys with bushy hill slopes, but that, given the necessary predisposing causes, it may also be of slight importance even in sparsely bushed open country. This fact also is attributable to the favourable conditions which such countries afford to fly and tick life.

Myiasis is a condition of importance in cattle primarily, and it is mainly its occurrence in this class of stock which necessitates its receiving serious consideration. Cases have, however, been reported in four other classes of domestic animals and occasionally in game.

The fact that game animals are resistant to infestation with larvæ is of considerable interest and importance, as, owing to the fact that the fly requires a living host for its reproduction, if the disease is successfully controlled in domestic animals (particularly cattle) there need be no fear of its being propagated amongst wild animals over which no control measures could be practised.

The apparent resistance of game to screw-worm is probably due to two main factors, *viz.*: (*a*) natural resistance to disease and debilitating conditions, and (*b*) decreased incidence of the predisposing causes of myiasis.

The above assumptions are based on the fact that native cattle are far less commonly found to be infested than are the European breeds and that, amongst the latter, cases are most frequent and most severe in animals in a debilitated condition.

Susceptibility.—All classes of cattle are susceptible to myiasis, but the incidence of the condition in different classes of stock varies considerably. This variation would appear in the main to be due to the conditions under which the animals are kept, the incidence of the predisposing causes and their relative susceptibility to the effects of these.

In general it may be stated that the hardier the animal and the more attention which it receives the less likely is it to become infested with screw-worm.

For instance, as a class, native cattle may be regarded as the least susceptible. This is attributed to their normal hardiness and therefore their capability of maintaining good health even under adverse conditions of grazing. In contrast to ranch cattle, native stock are docile as a result of kraaling and frequent handling, and consequently are not so liable to injury as the former when mustered for dipping or any other purpose. Finally tick infestation is less marked amongst them due, most probably, to more thoroughly controlled dipping. For reasons precisely opposite, improved breeds of cattle run under ranching conditions are most susceptible, but it should be remembered that, in addition to the above factors favouring the incidence of myiasis, most ranches are situated in bush country of a type in which ticks and screw-worm flies abound.

Again, under ranching conditions cases of myiasis are usually treated only on the dipping days, and *in the intervals between such days viable maggots will have had time to drop out, thus evading destruction which is so important a control measure*, with the inevitable result that veld infestation with the casual fly is progressively increased.

Observations made amongst ranch cattle indicate that cows and heifers are the most frequently infested, and thereafter calves, steers, oxen and bulls in that order, an injured vulva apparently being the predilective site for screw-worm.

Conditions Predisposing to Myiasis.—These have been dealt with to some extent in a previous article, but too great emphasis cannot be placed upon them, as, without the operation of predisposing causes, the actual cause, the larvæ of *Chr. bezziana*, cannot operate.

Chr. bezziana in the larval stage of its life cycle requires a living vetebrate host, *i.e.*, in this stage it is parasitic. Access to such a host can only be gained through the injured or damaged surface of the skin. In other words, *if the entire body surface of an animal can be maintained in an uninjured state no screw-worm can invade it.* To achieve such an ideal in nature is impossible, but every effort should be made to prevent injuries of certain types which are particularly attractive to the pregnant Screw-worm Fly.

Wounds of all types and in all positions on the body are potential sites for the deposition of eggs by *Chr. bezziana*, and the subsequent infestation with screw-worms.

The methods whereby wounds may be produced are too numerous and varied to attempt to describe here, but there are certain particularly common, and in many cases readily preventable, causes of injuries which deserve consideration, especially those which so commonly lead to myiasis.

Ticks.—It is the general opinion throughout the country that the vast majority of screw-worm cases result through primary injury to the body surface by ticks, especially the Bont-leg tick (*Hyalomma ægyptium impressum*) and the Bont tick (*Amblyomma hebræum*). Both these species of ticks possess particularly long mouth-parts, and hence are capable of causing deep injuries with resulting greater exudation of body fluids which are so attractive as food to the fly. The commonest sites of screw-worm infestation, *viz.*, the anal, vulva, perineal and crutch regions, correspond with the predilective sites of attachment of the above mentioned two species of ticks.

Tick infestation of the ears is another frequent cause predisposing to myiasis. Gross tick infestation of such parts results in such considerable irritation to the animals that, in an effort to obtain relief, they rub up against projecting objects such as stumps, branches or even stones. In this way engorged ticks may be ruptured or further injury to the ear and its neighbourhood produced, either of which leads to the accumulation of blood and exudates in the ear which attracts the attention of the Screw-worm Fly. A one-eared, or even an earless animal is not an uncommon sight on ranches where tick infestation and myiasis are bad.

Accidents.—Dissolution of continuity of a body surface may result from any and every type of accident, but the most common cause appears to be horning. It is well known that poking of one beast by another takes place when cattle are mustered or crowded, especially those animals which normally are out on open range and are only massed together for such purposes as dipping, sorting, etc. The effects of such pokes are most noticeable in those parts which are particularly common sites of myiasis, *i.e.*, from the tail-head down to the udder or sheath. Injuries resulting from pokes on the general surface of the body, *i.e.*, over the sides, are usually in the form of long narrow abrasions which usually dry and crust over quickly, and are only therefore attractive to the fly for a brief period.

A type of injury which appears rarely to escape infestation with screw-worm is that of a broken horns—such injury is almost most commonly sustained during crowding. In an effort to eliminate wounds resulting from poking, as also other disadvantages inherent in horned stock, dehorning is often resorted to. It is regrettable to record that due to faulty technique in its widest sense, this attempt to overcome the evil frequently results in an even greater number of cases of myiasis.

Surgical or Intentional Artificial Injuries. Under this heading are included such common operations are castration, branding and dehorning. The adoption of the bloodless method of castration by means of the Budizzo pincers reduces the chance of myiasis developing as a sequel to castration to a negligible minimum.

The burns resulting from properly carried out branding are not attractive to the Screw-worm Fly, but those resulting from bad branding, *e.g.*, performed with too cold or too hot an iron and followed by the sloughing off of patches of skin, are favourable egg-laying sites. Dehorning any cattle except very young calves results in considerable bleeding and exudation and consequently affords a wound ideal for the development of screw-worms. In dehorning young calves accidents occur relatively frequently which may lead to screw-worm invasion. For example, in dehorning with a caustic pencil

excessive application of the chemical, or especially its diffusion as the result of wetting of the skin, causes skin sloughs around and running down from the horn button, and these attract Screw-worm Flies; accidents with the hot iron method of dehorning appear to be less common and they are usually due to the same faults as discussed in connection with branding.

As distinct from the "immediate" accidents of dehorning we have the "subsequent" accidents or effects, *e.g.*, faulty dehorning resulting in only partial destruction of the horn-forming tissues, in which case it is not uncommon to find horns growing downwards and inwards causing pressure necrosis of the skin and even deeper tissues of the face. Such necrotic areas provide satisfactory sites for the development of screw-worms.

Specific Diseases.—Any disease which leads to damage of the body surface may, in this respect, be a predisposing cause of myiasis. The best examples in this country are Sweating Sickness of calves and Foot and Mouth disease. Sweating Sickness frequently causes extensive skin sloughs with a moist surface, and such areas furnish a portal of entry for the screw-worms. Similiarly, the ruptured vesicles between the claws or on the coronet of cattle infected with Foot and Mouth disease were frequent sites of myiasis during the recent epizootic.

Contagious Abortion may also predispose to myiasis, the discharges associated with this disease causing soiling or scalding of the vulva and its adjacent structures.

The discharges following normal calving are occasionally sufficiently profuse to produce effects similar to those observed in cases of abortion.

The navel, or ambilicus, of new-born calves, especially when for any reason healing is delayed, is also a relatively common seat of screw-worm infestation.

Symptoms and Pathogenesis.—The symptoms of myiasis are unfortunately too well known to almost every stock owner in the country to warrant a description here. In cattle any maggot-infested wound may be regarded as a case of myiasis due to *Chr. bezziana*—other species of fly-larvæ found in such

wounds representing secondary strike. Cases of myiasis in a herd can usually be detected by their smell even before the wounds are seen. The screw-worm-infested wounds themselves, as will readily be appreciated after a consideration of the predisposing causes, may vary greatly in appearance, *e.g.*, in reference to size, shape, depth, location, etc. They are characterised, however, by a profuse foul smelling, blood-stained, serous exudate with shreds of only partially digested or liquified tissue protruding from the opening. If such exudates are watched it will be seen that the surface is being constantly disturbed due to the movements of the maggots under it. The maggots themselves are also readily seen, as, for breathing purposes, it is essential for the hind-end to project, even if only periodically, through the surface of the exudates. The finding of the maggots leaves no doubt as to diagnosis.

The way in which screw-worms produce their effects has not yet been clearly determined, but evidence suggests that there is a definite association between the maggots, bacteria and/or enzymes. It is probable that the latter are specific and responsible for liquifaction of the body tissues of the animal, thereby reducing them to a state which enables the maggots to ingest and digest them.

Investigations are being conducted in an attempt to ascertain the particular species of bacteria, or type of enzyme, essential for the development of the larvæ to maturity, and to determine the method whereby such symbionts or synergists are acquired by *Chr. bezziana.*

It may be as a result of these researches that some satisfactory means of controlling the screw-worm menace will finally be evolved.

Treatment and Control.—These aspects of the subject have been dealt with at some length in an article in the February *Rhodesia Agricultural Journal* and it is not proposed to deal further with them now.

It should, however, be borne in mind that a myiasis wound, after removal of maggots, becomes an ordinary wound, and provided the damage has not been too extensive, such

Plate I — Typical cases of Myiasis in Cattle.

Plate II —Fig 1 *C bezziana.* The Screw-worm Fly   Fig 2. *C marginalis* A common Blow-fly

wounds are readily amenable to treatment on ordinary lines. The difficulty in practice, however, where many cases are under treatment and the animals cannot be kept stabled, is to maintain the wound as an ordinary wound, *i.e.*, free from maggots. Re-infestation of a screw-worm infested wound which has been cleared of larvæ is only too common. Many cases of so-called re-infestation are, however, nothing more than a continuation of the previous infestation due to faulty or incomplete cleaning in the first instance.

Control measures should aim at two main objects.

(*a*) Prevention and elimination of the predisposing causes, especially those which have been cited above.

(*b*) Reduction of the incidence of the fly by attacking it at the weakest link in its life cycle, *i.e.*, the screw-worm stage. This can only be satisfactorily achieved by conscientious and frequent treatment of every case of myiasis to ensure that every larva which is developing in the wound is destroyed before it reaches the stage of pupation in the soil.

Dairy Buildings in Southern Rhodesia.

A SMALL FARM DAIRY.

By B. G. Gundry, A.I.Mech.E.

The site of a dairy requires rather careful consideration, since its utility will be considerably impaired if it is badly situated. The spot selected should be one where the building will be exposed to the prevailing winds, and care should be taken that it will not be in the path of dust raised by traffic on a nearby road or yard. It should also be as far removed as possible from stagnant water, a dungstead or other habitat of flies and other insects. At the same time it should be conveniently situated with regard to the cow byres, and it is a great convenience if there is a good water supply at hand.

In the above connection, attention is called to the regulations embodied in the Dairy Produce Act of 1925, where it is stated: (1) that no person shall . . . erect or use any premises as a creamery, cheese factory, cream depot, butter dairy, cheese dairy or room used for separating purposes or storing of cream or milk within a distance of 300 feet from any piggery, manure heap or offensive stagnant water, and (2) that the room used for separating purposes must be at a distance of not less than 50 feet from any milking shed or kraal; and (3) that no person shall permit any offensive or decomposing liquid to be or to flow within a distance of 300 feet from any creamery, cheese factory, cream depot, butter dairy, cheese dairy or room used for separating purposes or storing of cream or milk, unless in a drain properly constructed to the satisfaction of the inspector.

If the dairy is roofed with thatch, which is recommended, on account of coolness, the question of fire insurance must also be considered. Generally speaking, Fire Insurance Companies insist that a building with a thatched roof must be separated from other buildings having iron or other non-inflammable roofs by a distance of at least 20 feet, failing

which the latter buildings may also be liable to the higher rate of premium which is applicable to that with the thatched roof.

Foundations.—The foundation trenches must be carried down until a good compact formation is encountered, and in most cases a depth of from 18 ins. to 24 ins. is sufficient. The bottom of the trenches, which should be as level as possible, should be well rammed to solidify the sub-soil still further and to ensure that there are no soft patches, which, if found, must be further rammed until sufficiently hard.

The first three or four courses of brickwork should be 18 ins. wide, followed by 14 in. work until the ground level is reached, when the 9 in. walls may be commenced. At a height of 6 ins. to 9 ins. above the ground level, the brickwork should be carefully levelled off ready to receive the damp course. Only good hard well-burnt bricks should be used for the foundations, and they may be laid in lime mortar of one part lime to 4 or 5 parts of clean pit sand or fine river sand. On no account should dagga be used for laying foundations.

The damp course may be of felt or 26 G. galvanised iron. If iron is used, the sheets should be cut into strips 12 ins. wide, and each strip should overlap its neighbour by about 6 ins., and, for preference, every joint should be soldered; but failing this, the strips should be turned over, hooked together and hammered flat, care being taken not to damage the galvanising unduly or the iron will soon rust through.

If galvanised iron is used it should not be placed in contact with lime mortar, and to avoid this the courses of brick work immediately above and below the iron should be laid in 1 to 4 cement mortar.

The damp course must project as far as possible on the inside of the wall, so that later it can be thoroughly embedded in the concrete floor.

Walls.—In this design the walls are built solid, no insulating air cavity being left, as it is considered that with a verandah provided on all sides the building will be kept sufficiently cool.

If good building dagga is available it may be used for building the walls, although lime mortar of one part lime to

5 or 6 parts of sand is strongly recommended, as it is not so readily penetrated by insects.

The door and window frames are built in as the brickwork proceeds, being secured in position by strips of hoop iron screwed to the woodwork and built into the walls at intervals of five or six courses.

Two or three apertures about 6 ins. by 9 ins. should be left near the top of each wall for ventilation, and should be covered with mosquito gauze.

Verandah.—While the walls are being built the concrete footings for the verandah poles may be placed, so that they will be set by the time the roof is to be put on.

The mixture for the concrete should be 1 part cement, 3 parts sand and 6 parts stone broken to pass a 1 in. ring. If the ground is sufficiently firm, square holes 9 ins. by 9 ins. may be dug to the requisite depth and filled with the concrete, a wooden mould about 4 ins. to 6 ins. high being used to support the concrete above the ground level. Otherwise, old petrol tins can be embedded in the ground and used as moulds.

As the concrete is being filled in, the iron straps, which must have been previously drilled for the bolts, must be inserted, and may be held in the correct position by strips of wood resting across the top of the mould. These footings are shown in detail in the accompanying drawing.

The concrete should be given at least seven days to set before the poles are bolted to the iron straps. These poles may be either of native timber or gum poles 4 ins. to 5 ins. in diameter, or, if preferred, 3 ins. square imported timber may be used. These uprights having been erected, the plate or bearer on which the rafters rest may be placed in position and secured to the uprights by strips of hoop iron. Here again either locally-grown timber, of approximately the same diameter as the uprights, or imported timber 4½ ins. by 3 ins. may be used as desired.

It must be remembered, however, that practically all native timbers and gum woods require to be chemically treated to render them immune from attack by white ants and borers. Such a treatment, which can be carried out in an ordinary

cattle dip, is fully described in the article entitled "Indigenous Timbers for Fencing," which appeared in the *Rhodesia Agricultural Journal* for October, 1924.

Roof and Ceiling.—The roof should have a pitch of not less than 45°, and the type of main principal recommended is shown in the accompanying drawing.

It is assumed that native timber or gum poles will be used for all the roof timbering with the exception of the tie beams, ceiling joists and wall plates, and the diameter, length and number required of the various members are shown in the schedule of quantities.

The roof principals should preferably be bolted together with ½ in. diameter bolts, and should be secured to the walls by strips of hoop iron built into the top six courses of brick-work.

A louvre ventilator should be built into the two end principals to ensure the roof being thoroughly ventilated. These may be rectangular, as shown in the drawing, and the surrounding space filled in with 26 G. galvanised iron, or the slats may be taken right across to fill the triangle completely

The thatch should project about 12 ins. over the louvres and it will therefore be necessary to use wooden purlins for this part of the roof. The remainder of the thatch can be supported by purlins of 10 gauge fencing wire secured to the rafters by iron staples.

The cheapest type of ceiling is of ordinary ceiling boards, which are also the easiest to fix; but they have the disadvantage of shrinking and warping badly and admitting dust from the thatched roof above. As an alternative, flat galvanised iron of 24 gauge may be used, but this will require a small amount of extra timber to support it and is somewhat more difficult to fix. The principals must be placed so that the distance from the centre to centre of the tie beams is exactly 3 feet, as this is the width of the sheets of iron. Cross members, known as brandering, consisting of 3 ins. by 1½ ins. imported timber, must be cut to the required length and nailed between the tie beams at intervals of 2 feet, so that their bottom edge is flush with the bottom edge of the tie beams, thus presenting

a level framework to which the sheets of iron are nailed. Strips of ceiling board cut 2 ins. wide are then tacked on the under side of the iron to give it further support and to cover the joints.

Floor.—The floor should be of concrete, 1 part cement 3 parts sand and 6 parts of stone laid on a 6 in. bed of hardcore which has been well consolidated by ramming. Full instructions for the laying of concrete floors are contained in an article entitled "Concrete on the Farm," which appeared in the *Rhodesia Agricultural Journal* for April, 1926, and reprinted as Bulletin No. 588.

General.—Two doors should be provided, the outer one consisting of a light wooden framework covered with mosquito gauze and an inner one made from ordinary flooring boards. These doors can be purchased ready made if required.

Glazed windows are not absolutely necessary, but may be fitted if required, in which case they should be hung on the inside of the window frame, so that they open flat against the wall. In the drawing glazed windows are dispensed with and wooden shutters made from flooring boards are hung on the outside of the frame. These can be closed when necessary to exclude dust, etc.

In any case the window openings should be provided with mosquito gauze screens.

A cement-plastered brick cooling trough with a drain pipe should be built under the window facing the prevailing winds.

The trough should be built as shown in the detail drawing and plastered with a mixture of one part cement and three parts of sand.

A bench consisting of a concrete top resting on brick pillars is also recommended. The concrete top should be cast in convenient size slabs from two to three feet long and four inches thick. The mixture used should be one part cement, two parts sand and four parts stone. The slabs should be given at least two weeks to set before being placed in position on the brick supports, and during that time they must be kept damp with wet sacks or grass.

The inside of the walls should be plastered to a height of two feet six inches with cement mortar, one part cement to four parts of sand, and the angles between the walls and floor should be carefully rounded to facilitate cleaning.

The upper part of the walls should be plastered with ordinary lime mortar.

Cost.—The estimated cost of materials *ex* Salisbury, as shown in the schedule of quantities, is approximately £46 this figure includes farm-made bricks at 12s. 6d. per thousand and a small cartage charge only for sand and stone. The cost of native timber is not included.

SMALL FARM DAIRY.

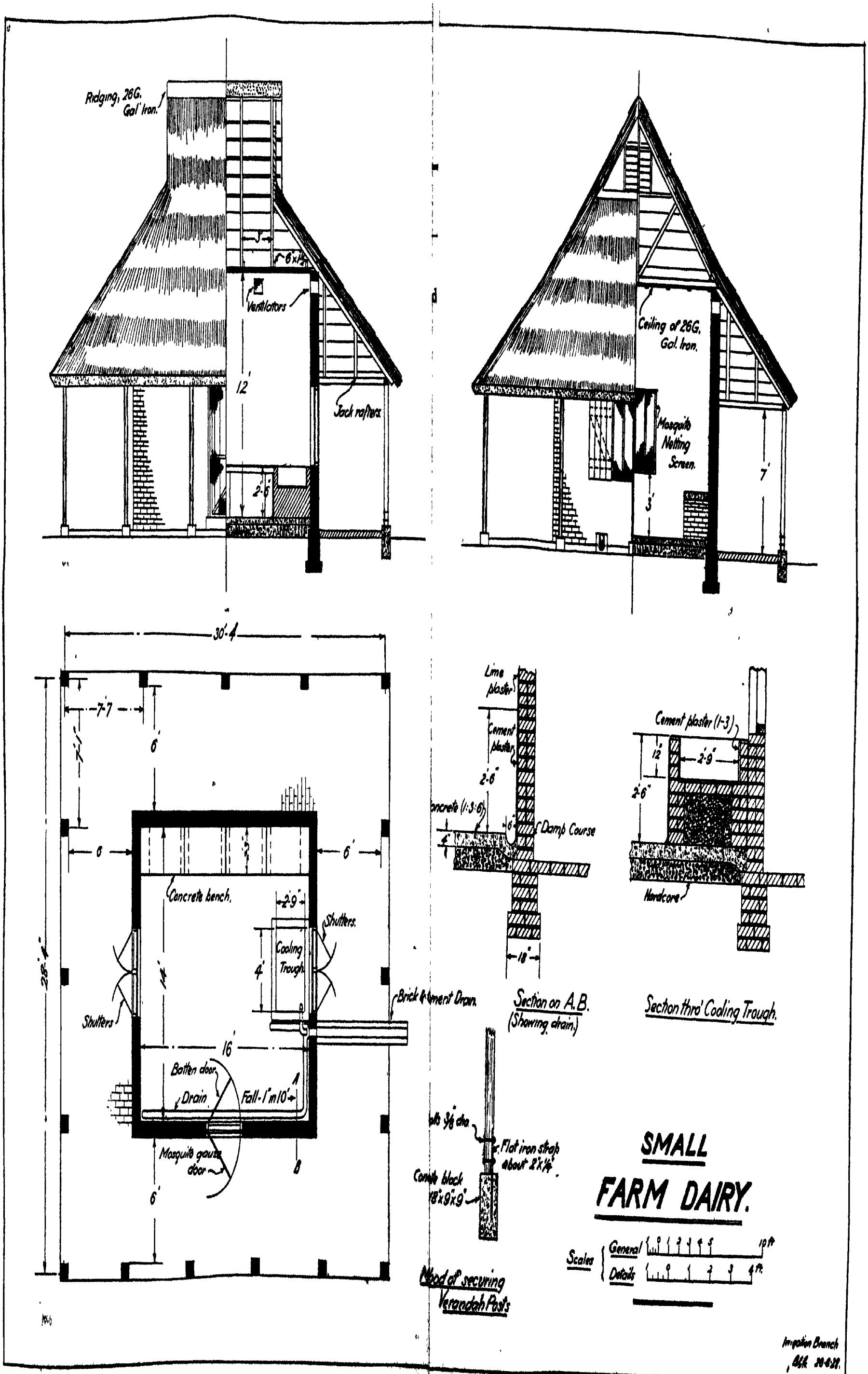
Schedule of Quantities of Materials.

Item.	Number or quantity.	Description.	Cost. £	s.	d.
Foundations	2,200	Bricks	8	2	6
Walls	8,000	,,			
Verandah floor	2,200	,,			
Cooling trough	350	,,			
Lime	14 bags		4	11	0
Concrete floor	7 ,,	Cement	4	18	0
	1½ cubic yards	Sand	0	3	0
	3 ,, ,,	Stone	0	12	0
Damp course	4 sheets	26 G. galv. iron	0	19	0
Walls, cement plaster	1½ bags	Cement	1	1	0
	½ cubic yard	Sand	0	1	0
,, lime plaster	2 bags	Lime	0	13	0
	1 cubic yard	Sand	0	2	0
Verandah, concrete footings for posts	1½ bags	Cement	1	1	0
	⅓ cubic yard	Sand	0	1	0
	⅔ ,,	Stone	0	3	0
Concrete bench top	1½ bags	Cement	1	1	0
	⅓ cubic yard	Sand	0	1	0
	⅔ ,,	Stone	0	3	0
Iron straps for verandah posts	17 x 2 ft. long	2 x ¼ ins. iron	1	10	0
Ridging	2 sheets	26 G. galv. iron	0	9	6
Flashing and filling for louvres	3 ,,	,,	0	14	3
Hoop iron...	1 bundle	...	1	10	0
Drain pipe for trough	3 feet	2 in. W.I. pipe	0	4	0
Elbows for above	2 ,,	2 in. elbow	0	2	6
Mosquito gauze, galvanised ...	5 yards	4 feet wide	0	14	0
Screws, nails, hinges, bolts, etc.		say	5	0	0

Timber.

Item.	Section.	Length.	Number	Cost.
Roof principals: tie beams ...	6 x 1½ ins.	Feet		£ s. d.
rafters	3-4 in. butts	16	4	1 4 0
king posts ...	,,	12	8	
struts	,,	8	4	
Ridge pole	,,	6	8	
Wall plate	4½ x 1½ ins.	11	1	
	,,	17	2	0 9 3
Ceiling joists	6 x 1½ ins.	15	2	0 8 0
,, boards	6 x ½ ins.	16	2	0 12 0
,, cornice	3 ins.	16	28	3 15 0
,, ,, ...	,,	16	2	0 6 0
Purlins, for ridge, timber... ...	1½-2 in. butts	14	2	0 5 6
,, 10 G. galvanised wire	10 G.	11	10	
Hip rafters	4 in. butts	½ roll	...	0 15 0
Verandah rafters for ends... ...	4 in. butts	19	8	
,, ,, ,, ...	,,	15	6	
,, ,, sides	3-4 in. butts	9	4	
,, jack rafters	,,	9	12	
,, posts	4-5 in. butts	5	8	
,, plate	,,	7	17	
,, ,, ...	,,	15	4	
Louvres, frame	4½ x 1½ ins.	16	4	
,, slats (ceiling boards)	6 x ½ ins.	9	4	0 9 9
Batten door (flooring)	6 x ⅞ in.	10	4	0 6 8
,, ,, ,, ...	,,	13	3	0 9 9
Mosquito-proof door...	3 x 1½ ins.	8	1	0 2 0
,, ,, ...	,,	13	1	0 2 6
Door frame	4½ x 3 ins.	8	2	0 3 0
,, ,, ...	,,	10	1	0 6 0
Mosquito gauze screens for window openings	4½ x 1½ ins.	7	1	0 4 0
	,,	9	4	0 9 9
Shutters for window openings (flooring)	6 x ⅞ ins.	12	2	0 6 6
		16	6	1 4 0

Note.—Since the above list was compiled in 1928 the price of imported timber has fallen by approximately 20%.


Ridging, 26G. Gal' Iron.
Ventilators
12'
Jack rafters.
2-6"
Ceiling of 26G. Gal. Iron.
Mosquito Netting Screen.
7'
3'
30'-4"
7'-7"
6'
Concrete bench.
2'-9"
Shutters.
Cooling Trough.
4'
14'
Brick & Cement Drain.
16'
Batten door.
Drain.
Fall-1" in 10'
A
B
Mosquito gauze door
28'-4"
Lime plaster
Cement plaster
2'-6"
Concrete (1:3:6)
Damp Course
18"
Section on A.B. (Showing drain.)
Cement plaster (1-3)
12
2'-6"
Hardcore
Section thro' Cooling Trough.
Flat iron strap about 2"x¼"
Concrete block 18"x9"x9"
Method of securing Verandah Posts
SMALL FARM DAIRY.
Scales General 10 Ft. Details 4 Ft.
Irrigation Branch

Moulting of Poultry.

THE NORMAL AND PULLET MOULT.

By H. G. Wheeldon, Poultry Officer.

The Normal Moult.—The natural season for poultry to moult—fowls, turkeys and waterfowl—is during late summer or the beginning of autumn, that is, during the months of January, February and March. It is during this period that the majority of the moulting birds do not lay. As long as a hen lays regularly she usually retains her old feathers for some time, but if for any reason other than sickness, debility or broodiness she stops laying, the feathers begin to drop and moulting has begun.

The order in which the moult develops is first from the head and neck, then the back, wings and body. The "neck or partial" moult may be noticed at any season of the year, even in good layers, but if the moult progresses to the back the primary feathers of the wings generally drop out, which is followed by a complete moult. This stage is seldom reached out of season, unless the hens have for some reason had a set-back and entirely stopped laying, or in other words, the cessation of laying is likely to bring on moulting. Normally, when the old feathers drop out new ones grow to take their place. Poultry seldom lay when the new feathers are growing, but exceptional individuals with good vitality are occasionally found which do lay during this period. Generally speaking, fowls which are kept in full lay will delay in the casting of their feathers and in this way many of the best layers may carry a large proportion of their old plumage beyond the normal season into the winter and then moult. It is, therefore, obvious, the later a hen moults in the autumn or winter the longer will be her laying season, and hence the greater will be her production.

Many poultry-keepers cull the early moulters, believing, not without reason, that they are less profitable than birds which continue producing well into the autumn or winter, but on this subject we cannot lay down hard and fast rules. The period at which a bird moults is a *good guide* in culling, but only when it is considered with other factors which may be termed correlative. To cull at the period at which a bird moults irrespective of the other factors, would mean that in some seasons it would be necessary to cull the whole flock. The date of hatching does not denote any definite month of moulting. One cannot say definitely that any special system will give definite results, as one may be successful with a certain system for several seasons, when invariably will come the time when all calculations and systems count for nought. This applies particularly to the prevention of the "pullet moult," and the forcing of an early moult in the old stock before the normal season. Hot, dry weather seems to check production and to hasten the moult.

The question as to how long fowls take to moult depends largely upon the atmospheric conditions, age and the treatment given to the birds during this trying period. Normally birds should not take longer than three months completely to grow their new feathers from the time they commence to moult. Old birds take longer than young birds to grow their new feathers and recommence laying, and they require special care to hasten them through; this applies particularly to the old breeding stock of the heavy varieties such as Wyandottes, Rhode Island Reds, Sussex, Orpingtons and Plymouth Rocks, which may be required for the forthcoming breeding season. The birds to be retained in the laying flock for another season should also be given some attention to hasten them through so that they will recommence laying as soon as possible to meet the demand for eggs, which usually fetch a high price at this time of the year.

The moult will be general during this and the next few months and it will be found advantageous in dealing with the moulting birds to have two pens set aside for all the hens that require attention, and as the moult progresses to move them from No. 1 to No. 2 pen. These pens should be shady and roomy.

Having got the pens ready—that is, clean and well littered—proceed as follows:—Remove all the hens as they stop laying to pen No. 1. These birds must be kept in lean condition by encouraging as much scratching exercise as possible and supplying them with grain food only, roughly about 1½ to 2 ozs. of this per bird daily. Eliminate all mash foods from their daily rations. Grit, charcoal and oyster shell must be given freely. Give green food in abundance, and see that they have all the fresh water necessary for drinking. Once a week, on fine days, put a little Epsom Salts in their drinking water to make it slightly saline to the taste. Within a month of this treatment the feathers should fall out freely. When this is noticed, examine the birds regularly and those that have cast feathers and those that have the most new young feathers just showing must be removed to pen No. 2. The birds in No. 2 pen require different treatment from those in No. 1 pen, and this is the reason for their being placed in different pens. As the birds are removed to No. 2 pen, see that they are free from insect vermin, and if these are troublesome dust the birds well with insect powder, taking great care not to injure the young growing feathers.

The treatment of these birds should be with a view to assisting the growth of the new feathers and building up their condition. They should be gradually brought back to the mash diet, to which may be added a little sulphur. A wet mash occasionally mixed with stewed linseed would also be beneficial to the birds at this stage. Take 1½ tablespoonfuls whole linseed and stew to a jelly in a pint of water and mix this to a crumbly consistency with bran. Give this once a day at the rate of about 1 dessertspoonful to each bird. Give green food in abundance, and grit, charcoal and oyster shell and fresh clean water daily. Add Douglas mixture to the drinking water two or three times a week, the dose being 1 dessertspoonful to each quart of water.

The grain mixture should be given in the evening covered in litter to induce exercise. Sunflower seed or linseed are valuable additions to the grain mixture for moulting birds.

As the birds become well feathered they should be removed to the breeding or laying pens and allowed to settle down to their permanent quarters as they come on to lay.

The Pullet Moult.—This may be termed a "premature moult" which, in conjunction with the "normal moult," has a very important bearing on the egg output of the country. It is during the next few months—the natural season for poultry to moult—that a marked shortage of eggs is experienced, and it is during this season of the year that our limitations are brought home to us. Although a shortage of eggs is experienced in the country as a whole, there is no doubt that there are successful individual poultry-keepers whose production is not very seriously curtailed during this period, and it is only when the successful men make the majority that the annual shortage will become less acute, because the experienced poultry-keeper raises pullets successfully to take the place of the moulting birds. The whole question seems to be based on experience and the systematic businesslike running of the plant. The extent to which anyone can take advantage of this period depends upon the ability to raise fresh stock each year to replace a proportion of the previous season's stock, and having raised the young stock to prevent them, during some seasons more than others, from going into a premature moult. In this connection readers should be reminded that the "cockerels" very seldom, if ever, fall into a premature moult, but if they are exposed to adverse conditions this may cause a partial or neck moult among the very early hatched cockerels. That the pullets are more susceptible no one will deny, and this may be accountable first to the highly developed nervous system of productive birds, which in turn is more sensitive to the environmental conditions and other influences.

It will be noticed that tame, friendly, high producing pullets are less likely to be affected than nervous or timid birds which are producing heavily. Having, therefore, hatched the pullets at the proper time and having provided them with comfortable environmental conditions, proper nutrition and a regular system of routine, it might be assumed that the pullets ought to behave satisfactorily so long as there be no untoward disturbance which will affect the nervous system, such as a fright or disturbance caused by dogs or wild vermin, or the birds are unsettled by being moved from one house or locality to another. Rough handling by the attendant or any abrupt change in the feeding (nutrition) also have an

important influence on the nervous system, as will exposure to rain or any other adverse weather conditions. It will naturally be concluded that the *nervous system* deserves some consideration in the matter of the "pullet moult" which successful men who study the requirements of the birds are able to deal with effectually. Similar examples may be recalled in other classes of productive stock when the production may be effected—those who are familiar with the highly productive milch cow have no doubt noticed a decreased yield in the milk when the regular milker is changed, as will irregularity in milking, rough handling or other disturbances affecting the nervous system. The regular gains in weight in fattening stock and the retarded growth or a weak spot in the staple of the wool in merino sheep are also attributed to disturbances as outlined above.

It is not unusual to find a small percentage of the first or early hatched pullets developing more quickly than the bulk of the early hatched stock, but this cannot be avoided during warm seasons, and fortunately it has never any very serious consequences even if these birds do moult. Early hatched pullets have been known to lay consistently without falling into a pullet moult, and the same season later hatched birds from the same strain have moulted and, although it seems difficult entirely to eradicate the moulting tendency all together in every flock of layers, careful management would certainly minimise it, even if the moult is due to some extent to hereditary. *Hereditary and environment are determining factors in the progress of practically every living thing. Proper environment and management may control even to the extent of overcoming the impediment of inherited weakness.* It is generally supposed by many poultry-keepers that the cessation of laying is the immediate result of a premature moult, but careful observation will show that in most cases the reverse will be the case.

Points to be considered in minimising the "pullet moult" may be summarised in the following:—

Suitable Houses.—Within the limits of the walls of the houses lies one of the important secrets in the successful prevention of the pullets moult; not only must adequate space be provided but proper ventilation, and also the roof must be

weather proof. A hard floor well littered is recommended, and cleanliness is a *sine qua non*. The aspect of the houses should be north, north-west or north-east in Rhodesia, and shelter and shade should be provided.

Maintaining Health.—For the best results it is necessary to keep the birds confined during the rainy season, but they must be given plenty of scratching exercise to keep them healthy by working for their grain food. The feed can be raked into the litter once or twice a day which will keep the birds contented and well occupied for several hours. Confinement is likely to give better protection and will avoid having to drive the birds into the houses when it rains. In addition to the grain food it is necessary to give a laying mash of good quality, the mash must be nourishing to provide for both production and development—special attention in this respect will be well repaid. Most of the pullets will develop better, continue to lay and avoid moulting if handled carefully with a view to keeping them contented, busy and undisturbed and free from insect vermin.

Nutrition.—Laying birds require plenty of good wholesome food. The pullet moult may in no small measure be attributed to a lack of proper nutrition. As pointed out, it is probable that if the pullets are kept laying steadily they will not moult—or if they do it will only be a slight neck or partial moult. If the pullets stop laying, during the normal moulting season of the old stock, they are almost sure to pass through a complete moult. Unless pullets which are early hatched receive suitable treatment, they will not be able to find the energy to provide for both production and development. Production may cease if there is something lacking in the management. It is necessary, therefore, to perfect the management and environmental conditions as much as possible to prevent or minimise the pullet moult.

Citrus Fruit Growing in Rhodesia.

By G. W. Marshall, Horticulturist.

(*Continued.*)

Cultivation.—All work connected with fruit growing must be carried out systematically, and a definite programme should be laid down and rigidly adhered to. Every detail of working is an important item and must be attended to at the correct season. There is a right time for all orchard work, and if this opportunity is once missed it is liable to be reflected in the next season's crop and even for longer periods. It is, unfortunately, a not infrequent occurrence for the orchardist to defer working up the land immediately after the rains have ceased. Thus when the delayed work is eventually carried out a good tilt is not obtained. Incalculable harm may be done to orange trees by delaying the autumn ploughing until so late that the ground has become too dry for effective tillages and much of the moisture has been evaporated. On the heavier soils too the earth breaks up into huge clods, and it may then take more than a whole season to bring back a good tilth to the grove. Instances could be quoted where such delays have occurred in cultural operations, with the result that the crops of fruit then maturing were impaired and the crops set a few months later were greatly reduced. Delay in carrying out the necessary cultural operations usually spells loss of crop, and these remarks apply not only to cultivation, but to all phases of citrus work.

Cultivation is beneficial and necessary in many ways to the general health of an orchard. It pulverises the earth and allows aeration of the soil, and the water-retaining capacity of the land is increased and the rain more readily penetrates to the deepest layers. Evaporation is checked by the reasonably fine top mulch produced by good tillage.

In Rhodesia we must always be prepared for a possible shortage of rain and the certainty of a period of six or seven months when no appreciable rainfall can be expected, and we must adapt our system of cultivation accordingly.

Before the wet season arrives the whole orchard should be thoroughly cultivated and cross cultivated so as to be in a condition to receive the greatest possible benefit from the rains that may fall. When this cultivation is completed it is advisable to sow a cover crop such as Sunn hemp or some kind of bush bean over the whole area between the trees after the first good rains have fallen. The seed should be disced or drilled in and the green crop should be turned under towards the end of the wet season. This green crop not only provides necessary humus and nitrogen, but the growing of the cover crop assists in preventing soil erosion during heavy rains.

After cover crop has been sown the land should be disced and harrowed. To avoid unnecessary soil erosion when the citrus grove is rather sloping, the first cultivation should be up and down the slope and the cross cultivations along the contour rows; and further, whether a cover crop is sown or not after harrowing the land, a good deep furrow should be plouged along the centre of each row of trees and also along the contour line. It is assumed, of course, that the necessary storm water furrows have been constructed above the whole area, and the furrows referred to between the rows and along the contours will help to carry off the surplus rain water that actually falls on the grove during heavy thunderstorms. These furrows should be taken to the ends of each block of trees, where a main drain can be made to carry off the water to a convenient donga or some natural water course. The contour furrows will also be of great assistance during any dry spell that may occur during the growth of the cover crop for the irrigation of the citrus trees or cover crop if either is in need of water.

Many citrus crops have been adversely affected where no provision was made for irrigation during the growth of the cover crop. Attempts have frequently been made to draw irrigation or storm water furrows after the cover crops are well advanced in growth, but most of these attempts ended

Fig 20 Underground standpipe system of irrigation distributary largely in use in California and installed in a few instances in Rhodesia where an open brick distributary would be ineffective.

This illustration shows a line being laid at the Mazoe Citrus Estate.

Fig 23 A well shaped orange tree, but a few small branches may be removed to prevent fruit touching the ground.

Fig. 25.--Zyklon fumigation at Riversdale Estate.

in failure and the trees suffered through lack of necessary moisture, often at a very critical stage in the development of the young fruit.

The only cultivation necessary during the growth of the cover crop would be that of loosening the soil round any newly-planted and small trees to stop weed growth; young trees should never lack a sufficient supply of air and light during their first few years in the grove.

When the cover crop has attained its maximum growth, and if the rainy season is drawing to a close, or if the grove soil is not too wet to plough, the cover crop should be turned under by ploughing first in one direction between the rows with a mouldboard plough to a depth of from five to six inches, and then, when the turned-under cover crop is sufficiently decomposed and is not likely to be dragged out of the soil again, the grove should be cross ploughed, this time to a depth of about eight inches. By setting the plough at the greater depth when cross ploughing no vegetable matter will be left on the surface of the soil.

It is always advisable to set the ploughs at different depths when ploughing the citrus grove; this will prevent the formation of a plough pan or hard compact layer of soil. The soil between all young trees should be deeply ploughed from the time they are planted; the deeper the ploughing, the better the results in after years, since it checks surface rooting and the green crops or manure are turned well under the soil surface and the tree roots will not work to the surface layer of the soil in search of nourishment.

It may be necessary to vary the depth of ploughing in the grove as the citrus trees become older. If excessive root injury is likely to occur near the trees, the plough should be set shallow, then gradually deepened until the maximum depth is reached midway between the trees. Care must be exercised when ploughing the citrus grove that the gradient is not unduly affected; to keep the soil surface uniformly graded, the soil must be alternately ploughed towards and then away from the trees.

When the ploughing and cross ploughing have been thoroughly done, the soil should be well harrowed in both

directions and then cultivated on the contour with a spring tooth harrow. This contour cultivation is a necessary precautionary measure against the erosion of loose soil should heavy rain occur.

The unploughed soil under the citrus trees must also be dug over at this season of the year, when all the weed growth and fallen leaves will be turned under; the surface soil must be kept level. An ordinary digging spade is best for this work, as the hoe or folk is likely to damage any shallow roots. With the spade it is possible to slide its blade one or two inches beneath the surface of the soil where the roots are very near the surface then lift the soil and turn it over completely to bury any humus-forming material.

When all the soil has been worked by ploughing and digging it should receive fairly frequently cultivation, preferably with a spring tooth harrow, until the fruit is harvested. The period between these cultivations should not exceed one month if evaporation of the soil moisture is to be effectively checked.

Cultivation is also necessary when the soil is sufficiently dry after each irrigation, for the advantages derived from these after irigation cultivations are the same as those previously enumerated.

The use of oxen in a citrus grove for any of the cultural operations is strongly condemned by some writers, but this practice is not an objectionable one where reasonable and necessary precautions are taken. If the draught animals are humanely muzzled and the implements adjust to run nearer the trees than the animals, no damage will be done.

Mules or horses when available are undoubtedly better for this work, but many of the citrus growers are unable to spare any additional outlay for the purchase of these animals. Rather than neglect any of the necessary cultural operations, use oxen, but see they are well trained and handled by a reliable man before using them in the grove. Cattle are necessary on all Rhodesian citrus propositions for the production of the all-important farmyard manure, and this alone justifies their retention for cultural work.

Where a few mules are available they may be used to plough or work near the trees, the oxen doing the rest.

Mechanical transport may be used for all cultural operations, but the first cost of the outfit, together with maintenance and high-priced fuel, does not usually warrant its use when production costs have to be considered.

Inter-Cropping.—Under some circumstances young citrus trees are successfully inter-cropped, but it should not be undertaken unless proper cultivation is given and manure liberally applied. This enables the man with limited capital to overcome the initial expenses of cultivation, and incidentally leads to regular cultivation between the trees. Tall-growing plants such as maize should be avoided, and the inter-crops restricted to such as peas, beans, tomatoes, potatoes, etc., which ever suit the conditions best and are likely to be the most profitable.

Manuring and Use of Fertilisers.—In the manuring of citrus trees the first object is to produce thrifty trees, as subsequent fertilising for fruit will not give satisfactory results with poorly grown and partially developed trees.

In order to promote growth a liberal supply of kraal manure and commercial fertiliser should be used and the soil kept in the best mechanical condition. When the citrus grove is in full bearing there is a heavy draft upon the plant food in the soil, and to meet this, manure and fertiliser should be liberally applied. The production period of the citrus grove will be materially lengthened by the judicious use of these materials.

It may be that in many suitable sites for growing citrus fruit in Rhodesia little or no fertiliser will be required until the first fruit crop is borne, which will be, speaking generally, in the fourth year. Previous to this it may have been necessary to apply some manure in small quantities in order to keep the trees in healthy growth. But from this period on fertilising the grove with both organic and commercial fertilisers becomes a serious and necessary operation if the trees are to give satisfactory returns.

It does not pay to allow the trees to so far deplete the soil of plant food that their health is impaired, as if this does occur the trees will receive such a set-back that both quantity and quality of fruit are reduced.

The elements that it has usually been found necessary to add are nitrogen (N), phosphorus (P), and potsh (K).

The depletion of these elements through cropping can better be understood by stating the amount of each found present in an orange.

Bulletin No. 93 of the Californian Agricultural Experiment Station gives the average analysis of four common varieties of oranges as 0.19 per cent. of nitrogen, 0.058 per cent. phosphoric acid and 0.219 per cent. of potash.

Assuming an orange tree to produce 800 lbs. of fruit a year, and accepting the above composition of the fruit, each tree will annually remove from the soil 1.52 lbs. of nitrogen, 0.465 lbs. of phosphoric acid and 1.75 lbs. of potash.

If simple, readily available, commercial fertiliser were used to replace these elements, each tree producing 800 lbs. of fruit would require each year about 10 lbs. of nitrate of soda, 15 per cent. N.; 2½ lbs. of superphosphate, 17 per cent. P_2O_5; and 1¾ lbs. of sulphate of potash, 49 per cent. K.

Simple or complete commercial fertilisers will give unsatisfactory results when used alone on soils deficient in humus, but if a combination of the commercial fertiliser and farmyard manure is applied, excellent results can be expected.

Kraal or stable manure containing ½ per cent. of nitrogen will replace the nitrogen present in the 800 lb. crop of oranges if about 300 lbs. of this material is applied to the soil surrounding each tree.

Fertiliser experiments to ascertain the plant food requirements of citrus trees have been in progress in Rhodesia for the past four years, and the results obtained to date tend to confirm Californian experience, in that the application of commercial fertilisers without humus-forming materials is of little value after the first few years. The records of the

many manurial treatments practised in the Union of South Africa and Rhodesia show that those in which a liberal amount of kraal manure and nitrogenous commercial fertiliser is used are those consistently giving good results.

Nitrogen is undoubtedly the most important plant food element for citrus trees, the next in importance being potash and lastly phosphoric acid.

Citrus trees require a considerable amount of potash, but very conflicting results have so far been obtained from the use of this element; this may, however, be attributable to the varying amount of available potash in our soils.

The chemical analysis of a citrus soil is of little avail when considering the fertilisation problem; the analysis will show what elements are present in the soil, but not the amounts which will be made use of by the crop. Owing to the many and varied soil conditions obtaining throughout Southern Rhodesia, it would be unwise to state any definite amounts of manure or fertiliser to apply; these must be ascertained by actual field trials in each particular grove. If citrus trees were able to speak, matters would be simplified when fertilising; they do, however, respond to the best treatment and in this way enlighten the grower as to what their requirements are.

As a basis to work on, well grown fifteen-year-old citrus trees could receive from five to ten tons of kraal manure per acre per annum, more if procurable, and also a complete commercial fertiliser similar in composition to that in use at the present time in Rhodesia. This fertiliser has been mixed on the recommendation of the late Chief Chemist, Mr. G. N. Blackshaw, O.B.E., B.Sc., F.I.C., its composition being 15 per cent. phosphoric oxide (P_2O_5), 7 per cent. nitrogen (N) and 8 per cent. potash (K).

This commercial citrus fertiliser may be applied at the rate of about 1 lb. for each year of tree's age, with a maximum of about 20 lbs. for a full grown tree. The trees will also receive a certain amount of nitrogen from the leguminous cover crops turned under each season.

An additional amount of readily available nitrogen in the form of nitrate of soda will also benefit citrus trees when applied at certain stages of the tree's growth.

Recently a controversy arose between South African authorities with regard to the importance of the principal plant food elements for citrus trees, the one side contending that a considerable amount of nitrogen was essential to produce the best results, and the other side advocating phosphoric oxide as the more important element.

Of the holders of these two diverse opinions the nitrogen advocate is undoubtedly nearer the mark, and his contention was amply borne out on a citrus estate in the Western Transvaal, where all of the bearing trees received a liberal amount of nitrogen over a period of eight years. The manures and fertilisers were confined to Government guano, blood meal, meat meal and kraal manure, and additional nitrogen was provided by the leguminous cover crops turned under each season. No phosphatic or potassic fertilisers were used, and the only phosphate and potash supplied were present in the guano and kraal manure.

The citrus trees on this estate are to-day possibly the finest conditioned trees to be found in South Africa. This was Dr. H. J. Webber's opinion when he saw the grove referred to in 1925, after having completed about one-half of his citrus survey.

Before this estate was acquired by the present owner the trees had been sadly neglected and were in a deplorable condition; the bearing trees ranged from 15 to possibly 70 years of age, and were almost devoid of foliage. Systematic manuring and fertilisation was then commenced, and the first crop, which amounted to about 400 cases, was thin-skinned and sour. Each succeeding year's treatment showed marked improvements as to quantity and quality of the fruit, and in 1925 a total of about 25,000 cases of fruit was harvested. While referring to the results on this estate it would be of interest to contrast the prices received for the fruit with those for fruit produced the same season in other citrus groves. These are tabulated as under:—

Extract from Overseas Salesman's Catalogue, issued 21st August, 1925.

Grown.	Variety.	Cases Sold.	Average Price.	Soil Treatment.
			s. d.	
Western Transvaal	Seedling	1,107	19 3	Nitrogenous.
do.	do.	466	9 6	No treatment.
Eastern Transvaal	Washington Navel	138	15 0	Unknown.
Eastern Cape ...	do.	569	22 0	do.

From the foregoing average prices it will be seen that the Western Transvaal seedling oranges, produced almost entirely on nitrogenous fertilisers, compared very favourably with the popular Washington Navel orange grown in the best orange area of the Eastern Cape. An increased average price of 4s. 3d. per case is shown over Eastern Transvaal Navel oranges, and 9s. 9d. above unfertilised Western Transvaal seedling oranges.

The best bearing trees on the Western Transvaal Estate here referred to received the following average applications of manure and fertiliser during the 1925 season; the yield of fruit is also stated:—

No. of Trees.	Age.	Treatment in lbs. per Tree.	Average Yield per Tree in lbs.
(1) 1,400	15	75 lbs. Kraal manure. 12 lbs. Govt. guano. 2 lbs. Blood meal.	560
(2) 300	30	180 lbs. Manure. 16 lbs. Meat meal. 2 lbs. Blood meal.	800
(3) 100	30	120 lbs. Manure. 8 lbs. Meat meal. 7 lbs. Blood meal.	1,200

These applications were by no means excessive, and it would have been safe to have increased the amounts applied if more had been procurable.

Californian citrus fertiliser experiments indicate the necessity for nitrogen, and recent experiments there show that citrus crops continue to increase, until the huge amount of 350 lbs. of actual nitrogen is applied per acre.

The unit value of nitrogen is high in this Colony and it would be unprofitable to apply this element above a definite amount. Very careful records of fertiliser costs must be kept, and when the value of the increased crop produced approaches that of the fertiliser bill, heavy fertilising becomes uneconomical.

The probable minimum manure and fertiliser requirements of a healthy fifteen-year-old orange tree are:—

Kraal manure...	200 lbs.	Applied August or February.
Commercial citrus mixture ... ($15\ P_2O_5$, 7 N, 8 K)	15 lbs.	7½ lbs. in February. 7½ lbs. in August.
Nitrate of soda	4 lbs.	2 lbs. in February. 2 lbs. in August.

These suggested amounts should be increased or decreased according to the age or size of the trees to be treated.

When to Apply Fertilisers.—Small and frequent applications of fertiliser produce the best results; the trees are then able to draw continuously on the plant foods thus supplied. Kraal manure may be spread and turned under during the slack season of the year or after fruit harvesting is completed. If the soil conditions permit of carting and spreading the manure just before ploughinig under any cover crop which may have been grown, the two can be turned in at one operation.

In the case of complete artificial fertilisers or nitrate of soda at least two dressings should be given—the first in early autumn to induce tree growth and the second in spring to assist fruit development.

(To be continued.)

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 16, March 1934.

Red Locust (*Nomadacris septemfasciata*).—No further egg-laying has been reported during March, the last of the winged swarms of the previous generation having died out before the end of February.

One egg deposit reported about mid-February is stated not to have hatched by the end of March.

A few swarms of hoppers still in the 2nd and 3rd stages were recorded towards the end of the month, but the majority of swarms began to moult to the adult stage during the second half of March. The result is the presence of a large number of small swarms of winged locusts, which had not moved about to any very great extent nor united into large swarms by the end of the month.

Some very large swarms of more mature fliers have, however, appeared flying from the east in the eastern districts of the Colony. These are undoubtedly swarms which have matured in the low veld of Portuguese East Africa. They have already penetrated the Colony for a considerable distance, apparently as far as the Mazoe and Salisbury districts.

The main direction of movements of these large swarms appears to be westerly (N.W.-S.W.), but movements in other directions have been reported.

Tropical Migratory Locust (*Locusta M. migratorioides*).—This species has not been identified nor reported in any stage during March. A few fair sized swarms were reported in February, but mostly small early matured swarms. It is not known whether the swarms united and migrated, or whether they merely dispersed or have died out.

The Campaign.—The operations against the hopper bands have been continued vigorously, but the campaign showed signs of drawing towards a close at the end of the month, due to the surviving hoppers obtaining wings.

The outbreak has proved to be of unprecedented extent and severity. Every district of the Colony has been infested, and the intensity of the outbreak has necessitated the provision of supplies considerably in excess of those used last year. Two hundred and twelve (212) tons of arsenite of soda have been distributed together with six thousand (6,000) gallons of cattle dip. Approximately seven thousand (7,000) bucket pumps have been provided, together with fifteen large hand-power barrel sprayers for use on lorries, or on their own wheels. These larger sprayers are reported to have done excellent work everywhere, chiefly due to their mobility and the large poison containers.

Whilst the better populated agricultural areas, especially in the maize belt, have been more or less cleared of hoppers through the combined efforts of the farmers and the Government, there is no doubt that large numbers of hoppers are maturing in the Colony. It is altogether impracticable to achieve anything approaching complete extermination of hoppers in a Colony such as Southern Rhodesia, in the face of an outbreak of the overwhelming nature of that being experienced. The operations have perforce been more or less confined to the defence of crops, a policy which was decided at the commencement of the campaign.

Damage to Crops.—Damage from hoppers to European crops has, on the whole, been slight, but native crops have suffered in certain areas, due to the fatalistic or superstitious attitude adopted by the natives themselves. Damage from invading winged swarms has been considerable, especially in some localities near the Eastern Border.

The possibility of severe damage to late maize from winged swarms bred in the Colony is not yet over, owing to the comparatively early maturing of the swarms and the lateness of crops in certain areas. If the farmers can defend their crops from fliers during the next few weeks, however, a normal European maize crop is anticipated.

Enemies, Etc.—Threadworm has caused the death of a considerable number of hoppers in certain areas.

Three species of parasitic maggots have been recorded from various localities and adults are being bred out. These include two species of *Tachinidæ* and one *Sarcophagid*.

The locust fungus, *Empusa grylli*, has been responsible for the complete destruction of a fair number of hopper swarms and a few flying swarms in the Lomagundi district.

Red Mites have been taken from large hoppers and fliers, but are not regarded as being of any importance.

Outlook.—As far as can be judged at present, the outlook for winter crops is anything but encouraging, as flying swarms seem likely to be very prevalent throughout the dry season.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

FEBRUARY, 1934.

AFRICAN COAST FEVER.

There have been no cases. The last case occurred twelve months ago.

TRYPANOSOMIASIS.

Five cases in Lomagundi district and one in Hartley district.

HORSESICKNESS.

Two cases reported in Gwelo and one in Charter district.

MALLEIN TEST.

Nil.

TUBERCULOSIS.

24 bulls, 14 heifers, 1 cow and 8 calves were tested on importation with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls 24, cows 1, heifers 22, sheep 743, pigs 50.

EXPORTATIONS.

Bulls 3, cows 3, calves 1, horses 8, donkeys 36, sheep 42.

To the United Kingdom *via* Union ports in cold storage: Beef, forequarters, 2,281; hindquarters, 2,373; boned quarters, 2,868; livers, 6,520 lbs.; tongues, 3,023 lbs.; shanks, 9,039 lbs.; tails, 89 lbs.; kidneys, 629 lbs.

Meat Products from Liebig's Factory: Beef fat, 21,700 lbs.; tongues, 960 lbs.; meat meal, 99,300 lbs.; meat extract, 19,889 lbs.; beef powder, 31,452 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

MARCH, 1934.

Pressure.—Means pressure for the month was below normal in the North, but above in the South.

Temperature.—Mean temperature for the month was about, or slightly above, normal at most stations.

Rainfall.—The rainfall amounted to about 3.0 inches, or about 1.1 inches below the average for the month. The total since October 1st is 22.8, making a deficiency of 3.8 inches for the season to date.

MARCH, 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch	...	...	97	61	86.5	67.0	76.7	75.1	74.4	68.1	72	65	...	1.86	5.0	6	...
Beit Bridge	963.6	...	101	59	89.9	68.5	79.2	...	76.4	68.1	65	64	5.9	.79	1.6	4	1,510
Bindura	890.7	...	85	59	80.9	63.7	72.3	...	70.0	65.6	79	63	5.8	4.19	5.5	13	3,698
Bulawayo	868.3	867.8	86	52	80.0	59.9	70.0	69.0	68.0	61.8	71	58	5.5	2.29	3.3	6	4,425
Chipinga	892.0	...	86	56	76.5	61.3	68.9	...	68.2	64.1	81	62	5.2	6.02	8.3	17	3,684
Enkeldoorn	857.1	...	84	53	77.9	58.4	68.1	68.7	66.5	61.7	77	58	4.7	2.81	3.7	14	4,787
Fort Victoria	895.1	894.7	90	53	80.8	61.4	71.1	69.0	69.6	64.2	74	61	3.2	1.87	3.7	10	3,570
Gwaai Siding	903.2	...	94	57	88.5	61.9	75.2	...	70.8	64.6	72	61	3.7	3.80	3.7	7	3,277
Gwanda	905.9	...	92	57	82.7	62.8	72.7	...	70.4	64.6	75	61	5.0	2.70	2.0	6	3,228
Gwelo	862.1	...	85	53	79.0	58.7	68.8	69.6	67.1	61.9	75	59	4.4	3.55	3.3	11	4,627
Hartley	885.9	...	89	53	82.9	59.6	71.2	71.8	68.7	64.1	78	62	3.5	1.93	4.3	7	3,878
Inyanga	835.8	...	79	49	74.0	56.5	65.2	...	66.6	59.5	66	55	5.1	3.66	5.9	13	5,513
Marandellas	837.3	...	81	52	75.6	57.1	66.3	...	65.3	59.9	74	56	5.7	3.82	5.8	12	5,450
Miami	878.0	...	85	56	78.9	61.9	70.4	...	68.8	65.1	82	63	6.1	6.27	5.5	20	4,077
Mount Darwin	...	...	85	56	82.0	63.9	73.0	...	71.0	67.1	82	65	6.7	4.74	3.6	13	3,178
Mount Nuza	801.3	...	71	48	63.7	52.3	58.0	...	57.7	55.5	88	54	6.7	8.21	...	16	6,667
Mtoko	876.6	...	85	57	81.6	62.1	71.9	...	70.2	64.6	75	61	3.6	3.39	3.5	11	4,140
New Year's Gift	...	...	91	57	82.8	62.6	72.7	71.9	70.5	66.1	79	64	...	2.54	4.3	15	2,690
Nuanetsi	961.2	...	100	58	87.7	66.3	77.0	...	75.7	68.4	68	65	5.7	2.26	2.6	6	1,650
Plumtree	863.7	...	88	55	81.5	60.7	71.1	...	70.0	61.8	63	57	3.7	3.34	...	10	4,549
Que Que	881.5	...	89	55	83.9	61.0	72.4	...	70.6	63.6	68	60	3.9	2.50	3.9	7	3,998
Riverbank	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4,090
Rusape	861.6	...	84	52	77.5	58.5	68.0	...	66.1	61.7	78	59	4.4	2.42	6.2	9	4,646
Salisbury	854.1	854.4	84	53	79.5	58.7	69.1	68.6	68.1	62.5	73	59	6.2	1.65	4.8	8	4,885
Shabani	906.8	...	91	55	83.0	63.5	73.2	...	70.8	65.3	75	62	6.4	1.65	5.1	10	3,192
Sinoia	887.2	...	88	54	83.5	60.9	72.2	...	70.7	65.5	76	63	3.9	2.87	4.0	18	3,793
Sipililo	884.2	...	82	58	79.3	62.3	70.8	...	70.4	65.3	77	63	3.9	3.75	4.1	16	3,875
Umtali	892.2	892.7	89	58	80.1	61.8	70.9	70.6	70.1	65.4	78	62	5.4	4.08	5.3	10	3,670
Wankie	925.9	...	95	64	89.4	68.6	79.0	...	75.2	68.1	70	65	4.1	2.50	3.1	10	2,566

Rainfall in March, 1934, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
1	...	4	...	...	...	...	...	12	48	16	5	4	1	1	...	...	...	..	...	13	27	...	...	...	..	10	6	30	2	24	...	203
2	1	61	14	1	1		...	...	6	55	27	5	23	...	...	...	4	...	1	28	10	...	...	...	..	3	3	25	4	.	2	274
3	...	83	84	14	2	...	3	5	..	2	15	135	18	54	...	...	8	1	..	106	...	1	...	...	...	...	..	8	...	...	63	602
4	...	15	11	...	...	...	...	1	16	19	9	24	17	...	..	..	...	...	1	50	51	...	...	...	6	8	1	19	4	...	5	257
5	...	18	...	...	...	...	..	1	72	21	44	1	7	..	..	7	...		18	22	36	9	...	.	..	...	. .	...	38	6	49	349
6	. .	...	...	...	2	...	..	13	7	5	23	56	2	...	4	...	. .	...	33	5	6	...	...	...	10	..	...	24	22	...	...	212
7	3	12	30	2	2	2	...	4	12	29	72	19	30	15	...	..	.	12	30	35	8	...	..	...	5	...	3	7	...	5	...	337
8	28	...	27	...	33	19	..	11	68	12	21	24	17	4	...	...	1	10	2	13	3	...	...	...	..	...	...	4	...	2	...	299
9	60	5	27	20	21	33	23	42	8	22	20	21	7	21	2	12	11	...	1	2	. .	28	2	...	...	...	3	7	...	...	...	398
10	11	...	7	...	...	77	...	70	20	95	36	1	6	38	...	...	..	...	5	6	...	10	...	...	...	...	...	24	2	...	...	408
Mean	11	17	12	3	5	9	3	14	31	28	28	14	12	7	—	3	2	2	9	21	19	6	—	—	2	3	2	15	9	7	10	304

Farming Calendar.

MAY.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions

from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus coddling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted.

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

JUNE.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perenials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding

ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire-guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold mornings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

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METEOROLOGICAL.

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MISCELLANEOUS.

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No. 554. Pisé-de-Terre, by P. B. Aird.
No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
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No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).
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THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Cattle to the Johannesburg Market.—A temporary agreement has been arrived at in regard to the supply of Rhodesian cattle to the Johannesburg and Witwatersrand area and subject to certain restrictions a maximum weekly total of 200 head of cattle may now be supplied to this market.

The total for the year should not, however, exceed 8,300 head, which is the average annual export for the three years ending 30th June, 1930. Provided this annual total is not exceeded permission may be obtained to increase the weekly shipments above 200 during any period of scarcity, dependent on the condition of the market.

It has been arranged that the Rhodesian cattle will be sold on the Tuesday market. This market is slightly smaller than the Monday market, the most popular one in the past, but it has been agreed that if prices are not as good on Tuesday as on other days of the week a re-arrangement will be considered. The Tuesday market has the advantage that selling on the cattle section commences in the quarantine market whereas, on Mondays, shipments have recently been so heavy that on several occasions all the cattle in the quarantine section have had to stand over until Tuesday.

There has been a large demand for permits to ship cattle to the Rand, and so far it has not been possible to allocate more than one short truck to each applicant. The bulk of the cattle shipped so far have only been of good medium quality, and it is the intention of the Government to prevent, if possible, the diversion of any large quantity of first-class chillers to Johannesburg by making the returns from export overseas progressively more attractive as the need arises.

Applications for permission to export to Johannesburg should be made to the Secretary, Department of Agriculture and Lands, Salisbury, on the 25th of each month or as soon thereafter as possible for export in the next calendar month.

Cattle must be the property of the applicant at the time the application is made, and oxen must weigh not less than 1,050 lbs. at the port of exit, and cows 790 lbs. The cattle must be estimated to dress not less than 50%. Certain veterinary restrictions have to be met, particulars of which can be obtained from any District Veterinary Surgeon.

Soil Erosion.—The article which appears elsewhere in this issue is recommended to all farmers in Southern Rhodesia as one worthy of the most serious consideration. In all parts of the world soil erosion is now looked upon as one of the greatest enemies of the farming community. In tropical and sub-tropical countries its effects are more marked than in temperate countries where the rainfall is usually lighter in character and more evenly distributed throughout the year.

There is no doubt that through countless ages, before Europeans occupied Southern Rhodesia, the process of soil erosion has continued and that many feet of what might have been excellent agricultural soil have been carried by storm water to the rivers and most of it to the sea. Under our conditions surface or sheet erosion is general over the Colony, and the extent to which it has occurred is made obvious in many places by the piled up granite boulders which were originally embedded in the upper layers of the soil.

In more recent times since the native population has been instrumental in clearing land of forest growth and in burning the grass and scrub vegetation over considerable areas, there is no doubt that in such places soil erosion has been encouraged. During the recent visit of Professor H. Humbert, of the National Museum, Paris, an opportunity occurred to ascertain how Southern Rhodesia compared with other parts of Central and South Africa and with Madagascar in regard to this important subject. Professor Humbert stated that the conditions were identical in all the parts of Africa and Madagascar that he had visited, and that he had records of instances where in the last twenty years no less than 2 feet of valuable agricultural soil had been eroded owing to the destruction of the natural vegetation and the disturbance of the soil for cultural purposes.

The most serious aspect of soil erosion under our conditions is that owing to the natural sheet erosion which takes place every year very little of the dead vegetable matter remains to become incorporated in the surface soil, and the humus layer, where such occurs, is relatively thin, and when this is removed the soil which then remains is very poor in quality. The effects of erosion are thus most serious in the better soils which usually occur in the more hilly parts of the Colony where anything approaching level lands are the exception. It has been found that where erosion is not checked all attempts to improve the remaining soil by green manuring, etc., are unsatisfactory. The article now published deals with the subject fully and gives full details of the measures which can be economically used to safeguard cultivated lands.

If further particulars and advice are required they may be obtained by writing to the Chief Division of Irrigation, Salisbury.

Interesting Behaviour of a Gemsbok in the Wankie Game Reserve.—During March last Mr. E. Davison, Game Warden of the Wankie Game Reserve, who was engaged in road construction in the interior of the Reserve, witnessed a remarkable incident in which a wild gemsbok, two milk cows and a pack-mule were the chief actors.

Mr. Davison's account of the incident is as follows:—"While moving camp from Guvalalla Pan to White Hill Pan a gemsbok was seen approaching the Pan just as the party moved off. It came up to within fifty yards of the natives and showed little fear. It then joined the milk cows, which became very indignant and there was every possibility of a fight. Efforts to separate the animals ended in a native being in danger of being gored. After about half an hour the animals quietened down and the party was able to move off, accompanied by the gemsbok.

Often this animal was in the lead and at other times bringing up the rear, sometimes with the dogs trotting contently at his heels. From all outward appearances the animal might have been in capitivity all its life. On arrival at White Hill Pan the gemsbok continued to graze peaceably with the cattle, until they were kraaled at night, when it lay down close to a mule which was tied to a tree, outside the kraal. By morning the animal had taken its departure, and has not been seen since. Photographs to illustrate this incident are appended.

I am unable to give an explanation of this occurrence. The animal, a bull about three years old, was in good condition. Its attitude towards the other animals showed merely a desire for company, it was not aggressive and merely defended itself when necessary. The incident is rendered more remarkable as there are several herds of gemsbok in this locality."

Suppression of Weeds by Chemicals.—The literature dealing with the destruction of weeds by chemical means is very diffuse and extensive, and this fact makes Mr. Long's booklet all the more welcome, as he has in it collected together most of the data on the subject from the scientific publications of the world. Farmers would do well to digest sections I. and II. on the losses due to weed infestation and the effect on fertilisers in reducing weeds respectively. In this Colony the regular dressing of sporting turf and lawns with heavy dressings of Sulphate of Ammonia has been found to encourage the growth of the desirable couch grasses and to discourage all the other types at the same time producing a fine dense sward.

Sulphuric acid and cyanamide are being largely used for the destruction of charlock in cereals, and the chlorates of sodium and potassium are also finding a wide use for weed destruction under special conditions. The use of sodium chlorate for the destruction of witch weed in maize lands has been thoroughly tested by this Department and proved to be very effective in solutions in water as weak as 1½ per cent. Troublesome patches of couch grass in arable lands have also been destroyed by two sprayings with a 10 per cent. solution of the same material, and most householders in the country could save themselves a good deal of trouble and expense by spraying their pathways and tennis courts with sodium chlorate. Arsenic pentoxide has shown promise in this country as an agent for the immediate destruction of weeds in lawns, the couch grass being browned off with the weeds but recovering quickly later.

The booklet extents to 57 pages, is compact, well illustrated and forms a very useful compendium of the information on the subject, and can be unreservedly recommended for the attention of those interested.

It may be obtained from the author at "The Birkins," Orchard Road, Hook, Surbiton, England, price 2/- net (by post 2/2).

Raising Dairy Calves on a Limited Amount of Whole Milk.

By C. A. Murray, M.Sc. Agr., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.

On farms where cream is sold and skim milk is available the rearing of calves presents little difficulty. The case is different, however, where farmers are selling whole milk in towns or to cheese factories. Under these conditions many dairymen consider it uneconomical to rear the calves because of the relatively high value of the milk.

Extensive investigations into the raising of calves without milk have been carried out in overseas countries. Although certain calf meals and milk substitutes have given fairly satisfactory results, it is now generally admitted that there is no satisfactory substitute for whole milk in the ration of young calves and that some whole milk must be fed for a while to give the calf a good start if satisfactory growth is to be made.

When rearing calves on a limited amount of whole milk the method usually followed is to give the calf a good start on whole milk for six to ten weeks only and then to rely on a suitable ration of concentrates and hay.

Review of Literature.—The literature on the subject is scattered and very extensive. Overseas workers such as Humphrey and Hulce (1916), Hulce and Nevens (1917), Hulce, Morrison and Humphrey (1923) and others (1) all report that calves made satisfactory growth when raised on a total of approximately 400 lbs. of whole milk, fed over a period of

(1) For References to Literature see pp. 418-419.

from 50 to 70 days, and supplemented by liberal amounts of both legume hay and suitable concentrate mixtures. In South Africa, however, these rations have not proved satisfactory in the past—Wande (1929) and Murray (1927-1930).

PLAN OF EXPERIMENT.

In view of the unsatisfactory results obtained in previous trials by the writer and others in South Africa more whole milk was fed in the first of the two experiments reported on here than would seem necessary judging by the results of the overseas investigations. In the second experiment the amount of milk fed was based on the results of the first experiment.

Calves Used.—The calves used in both experiments were by a good pure-bred Ayrshire bull out of grade Friesland cows.

Feeding and Management.—The calves were usually left with their dams for the first day only and then taken away and started in the experiment. Throughout the experiment they were fed separately in small pens and allowed out together for exercise in a small one-acre paddock. Each pen was fitted with a hay rack and a small manger. The milk and concentrates were fed twice daily and the calves had free access at all times to good quality lucerne hay in their racks. From the second week on they were encouraged to eat as much concentrates as possible, but during the fifth and sixth months the allowance of grain was limited to 5 lbs. each per day. The concentrates were fed dry.

To get more accurate information on the efficiency of the two rations the calves were not allowed any grazing.

Records Kept.—A few hours after birth and thereafter at 30 day intervals, individual weight and height measurements were taken of the calves. The method followed was that of Eckles (1920, p. 5).

Individual records were also kept of the amounts of hay and concentrates consumed and of the general observations made during the course of the experiment.

As the "Normal Growth" of Ayrshire X Grade Friesland calves is not known, it was decided to use, as a basis of comparison, Eckles' (1920, pp. 8 and 11) normal growth data for pure bred Frieslands (Holstein's), although it is realised that such a comparison is not altogether justified. In addition to

this standard of comparison the views of outside cattlemen of experience were obtained on the thriftiness, growth and development of the calves for age at the conclusion of the experiments.

EXPERIMENT 1.

Experiment 1 was carried out during the period 1st July, 1931, to 19th January, 1932. The five calves were born between the 1st and 23rd July, 1931.

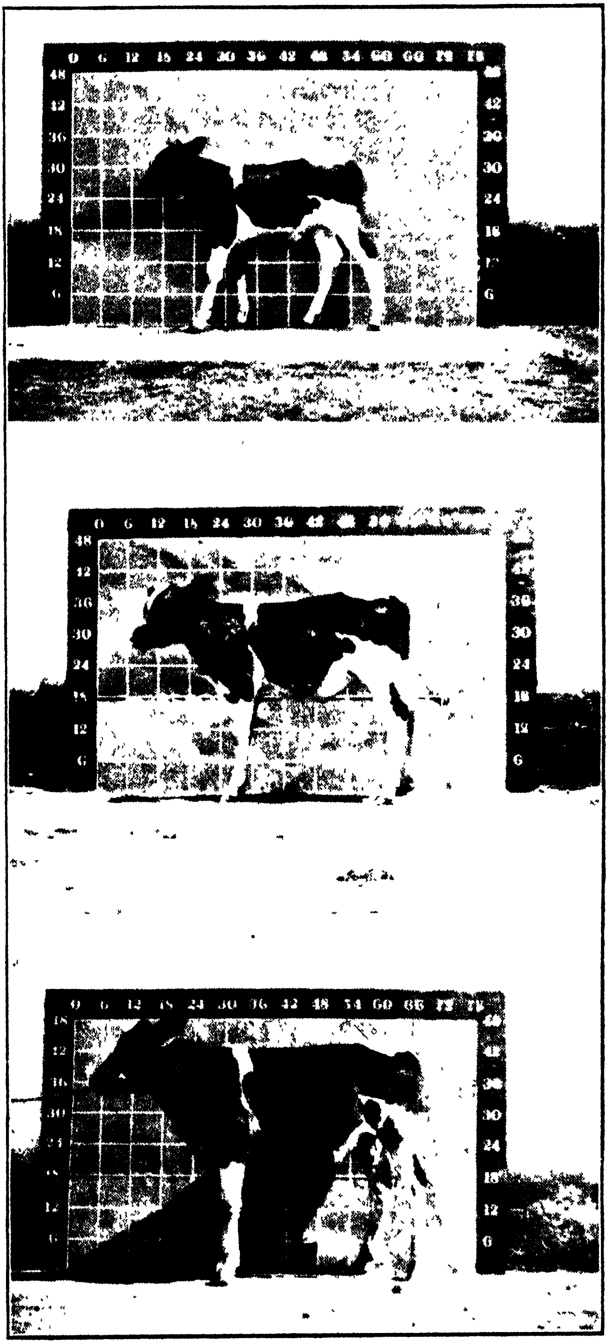
Ration Fed.—The calves were fed milk twice daily according to the following schedule:—

Period in days.	Period in weeks.	Whole milk per calf per day.
1st day with dam		
2nd day dam's milk	1st	4 pints.
3rd to 7th day dam's milk .		6 ,,
8th to 14th day whole milk ..	2nd	8 ,,
15th—21st ,, ,, ,, .	3rd	10 ,,
22nd—28th ,, ,, ,, ...	4th	10 ,,
29th—35th ,, ,, ,, ...	5th	12 ,,
36th—42nd ,, ,, ,,	6th	10 ,,
43rd—49th ,, ,, ,, ...	7th	8 ,,
50th—56th ,, ,, ,, ...	8th	6 ,,
57th—63rd ,, ,, ,, ..	9th	4 ,,
64th—70th ,, ,, ,, ...	10th	2 ,,
71st—180th ,, ,, ,, ..	11th to 26th	0 ,,

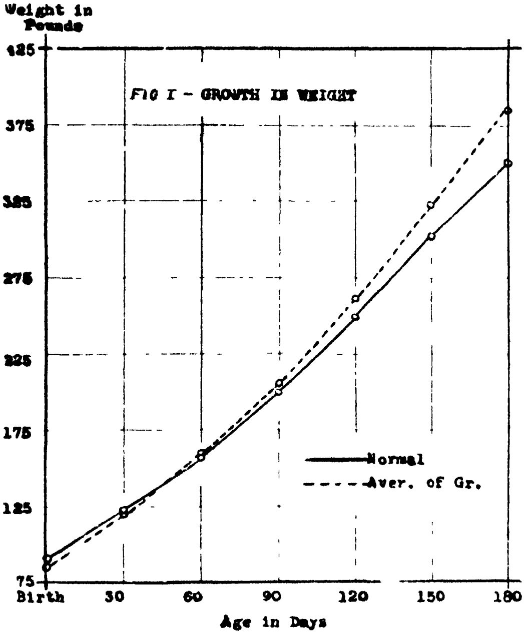
Each calf, therefore, received 655 lbs. of whole milk, or 635 lbs. of saleable milk.

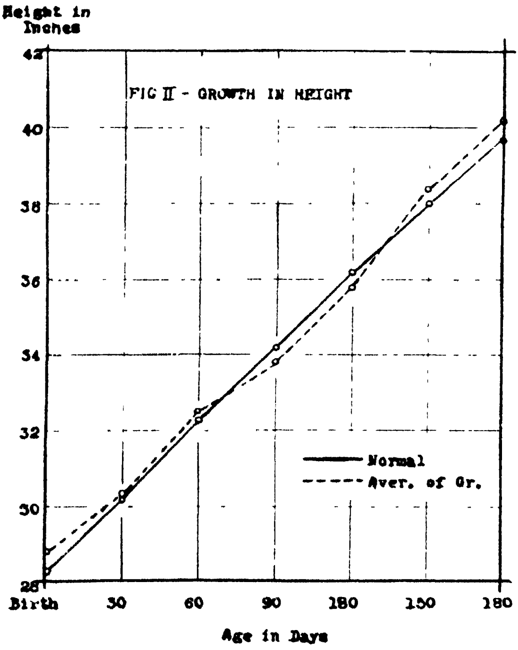
The following concentrate mixture was fed dry:—

150 lbs. maize meal.
50 lbs. bran.
50 lbs. peanut meal (52% Cr. Prot.).
25 lbs. bloodmeal (72% Cr. Prot.).
5 lbs. di-calcium phosphate.
5 lbs. salt.



Experiment I. At birth, at 3 months and at 6 months.





Experiment I.

EXPERIMENTAL RESULTS.

Table I.—Record of growth from birth to 180 days.

	Calf No. 8	Calf No. 9	Calf No. 10	Calf No. 11	Calf No. 33	Ave.	*Normal
Weight at birth, lbs.	90	80	84	102	75	86	90
Per cent. normal weight ...	100	89	93	113	83	96	
Weight at 180 days, lbs. .	410	395	270†	400	332	384	349
Per cent. normal weight .	117	113	89	115	95	110	
Height at birth, ins.	28.8	27.8	29.0	30.3	28 0	28.8	28.3
Per cent. normal height ..	102	98	102	107	99	102	
Height at 180 days, ins. .	41.3	39 4	39.1†	41.2	38 9	40.2	39.7
Per cent. normal height . .	104	99	103	104	98	101	

Growth of Calves.—From Table 1 it will be noticed that although the weights of some of the calves were below normal at birth all were normal as regards height.

The growth made by the calves up to the age of 180 days (150 days for Calf No. 10) was very satisfactory. The average weight at this age was 110% normal and height 100% normal.

Fig. 1 shows that the increase in weight was above normal and improved from birth to 180 days. In height (see Fig. 2) there was no similar corresponding increase in rate of growth. In this respect, however, the calves grew normally throughout, never varying more than 1% above or below normal.

Throughout the experiment the calves had a very thrifty appearance. They were very favourably commented on by several cattlemen as regards their condition, thriftiness and general appearance.

Table II.—Average monthly consumption of concentrates and hay per calf (1).

Month.	Concentrates lbs	Hay lbs.
1st	10	7
2nd	40	25
3rd	80	60
4th	104	73
5th	138	88
6th	160	103

*Eckles' (1920) normal growth data pure bred Frieslands (Holsteins).

†On the first day of the 6th month Calf No. 10 got sick and was removed from the experiment. It died a few days later from anaplasmosis. Data are therefore available only up to 150 days of age for this calf.

(1) Average figures for four calves only.

*Table III.—Average amount of feed consumed and feed cost per calf up to 180 days of age.**

Whole milk from 5 days of age.	Concentrates.	Hay.	Feed cost per calf.†
635 lbs.	532 lbs.	356 lbs.	£3 4 0

The amount of concentrates consumed per calf is in keeping with the results of overseas investigations, but the consumption of hay is slightly low.

The total feed cost amounted to £3 4s. 0d. per calf. This cannot be considered excessive. Of the total feed cost the milk accounted for 50% and the concentrates and hay for 50%.

SUMMARY.

During a period of 180 days the Ayrshire X grade Friesland calves in the experiment each consumed a total of 635 lbs. of whole milk, 532 lbs. of concentrates and 356 lbs. of hay. The whole milk was fed from the 5th to the 70th day.

The ration proved very satisfactory from a growth point of view. The average weight and height of the calves at 180 days of age were 110% and 100% normal respectively.

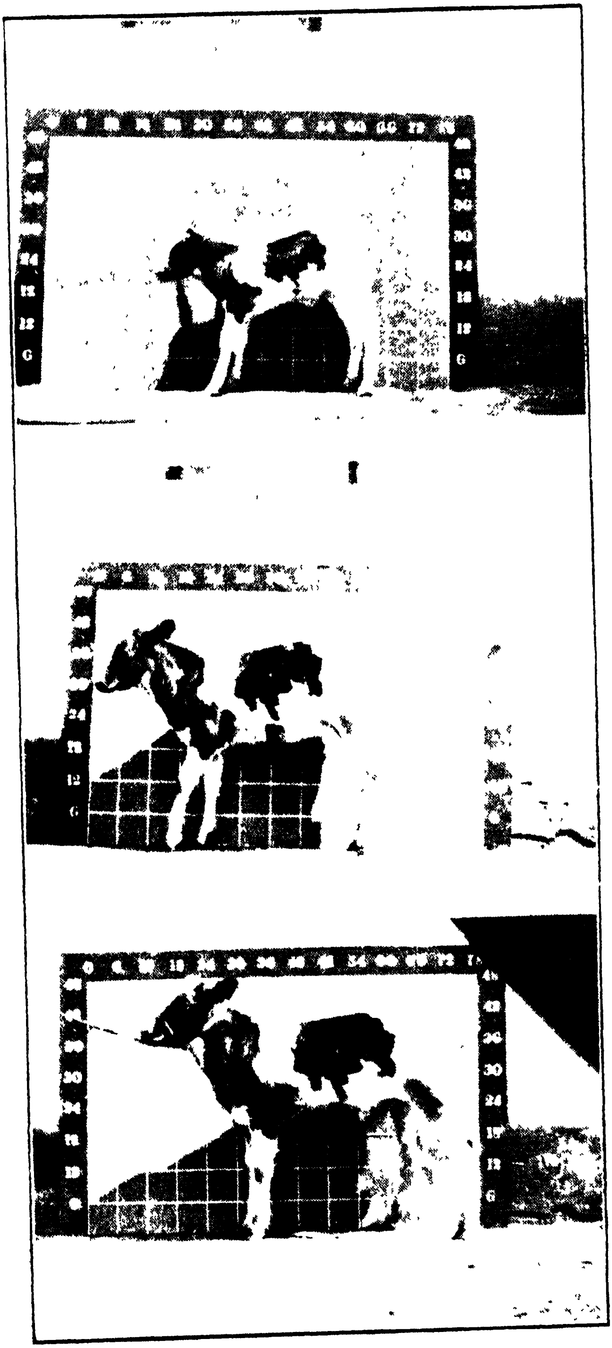
The cost of feed amounted to £3 4s. 0d. per calf. The whole milk accounted for 50% and the concentrates and hay for 50% of the feed costs.

EXPERIMENT 2.

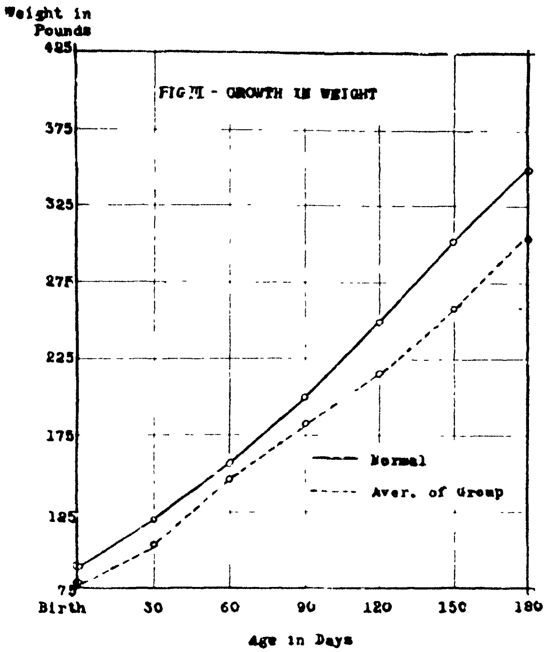
From the results of Experiment 1 it will be clear that, if the whole milk part of the ration could be reduced without loss of efficiency, the feed costs per calf would be reduced considerably. The object of Experiment 2 was, therefore, to

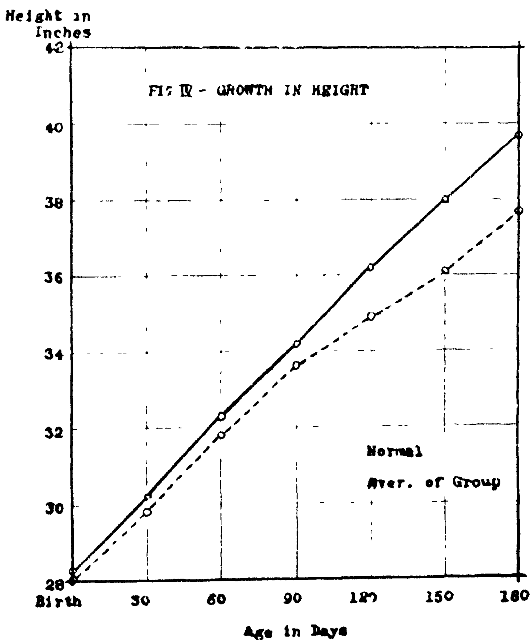
*Average figures given for four calves only. Calf No. 10 consumed 422 lbs. of concentrates and 286 lbs. of hay up to 150 days of age.

†Whole milk 6d. per gallon; lucerne hay, £2; maize meal, £5; peanut meal, £7 10s.; bran, £6; bloodmeal, £8; di-calcium phosphate, £15; salt, £3 10s. 0d. per ton.



Experiment II At birth, at 3 months and at 6 months.





Experiment II.

investigate the possibility of rearing calves successfully on a smaller allowance of whole milk than was fed in Experiment 1.

Experiment 2 was carried out during the period 22nd October, 1932, to 30th May, 1933. Seven calves, born between the 22nd October and 30th November, 1932, were used.

Rations Fed.—Whole milk was fed twice daily according to the following schedule:—

Period in days	Period in weeks	Whole milk per calf per day.
1st day with dam		
2nd day dam's milk	1st	4 pints.
3rd to 4th day dam's milk ...		6 ,,
5th to 7th day whole milk ...		6 ,,
8th to 14th day whole milk ...	2nd	8 ,,
15th—21st ,, ,, ,, ...	3rd	10 ,,
22nd—28th ,, ,, ,, ..	4th	8 ,,
29th—35th ,, ,, ,, ...	5th	6 ,,
36th—42nd ,, ,, ,, ..	6th	6 ,,
43rd—49th ,, ,, ,, ..	7th	4 ,,
50th—56th ,, ,, ,, ..	8th	2 ,,
57th—180th ,, ,, ,, ..	9th to 26th	0 ,,

Each calf, therefore, received a total of 428 lbs. of whole milk, or 408 lbs. of saleable milk.

The roughage and concentrate rations were the same as those fed in Experiment 1, *viz.*, lucerne hay and the following concentrate mixture:—

150 lbs. maize meal.
50 lbs. bran.
50 lbs. peanut meal.
25 lbs. bloodmeal.
5 lbs. di-calcium phosphate.
5 lbs. salt.

EXPERIMENTAL RESULTS.

Table IV.—Record of growth from birth to 180 days.

	Calf No. 60	Calf No. 61	Calf No. 82	Calf No. 62	Calf No 63*	Calf No. 16	Calf No. 64	Ave.	†Normal
Weight at birth, lbs.	73	86	74	74	75	85	80	78.1	90
Per cent. normal weight	81	96	82	82	83	94	89	87	
Weight at 180 days, lbs.	300	315	315	290	265	315	320	302.9	349
Per cent. normal weight	86	90	90	83	76	90	92	87	
Height at birth, inches	26 6	28.5	28.6	28.3	28 8	27 8	27.3	28 0	28 3
Per cent. normal height	94	101	101	100	102	98	97	99	
Height at 180 days, ins	37.2	38 1	38 3	38 8	37 3	37.8	37.2	37.8	39 7
Per cent. normal height	94	96	97	98	94	95	94	95	

Growth of Calves.—It will be seen from the individual birth weights and heights of the calves that they were on the whole smaller than those used in Experiment 1.

The average weight at birth was 78.1 lbs. (87% N.) and at 180 days of age 303 lbs. (87% N.) and, while the calves were practically normal as regards height at the commencement of the experiment, their average height at 180 days of age was 37.8 inches (95% N.).

The growth data show, therefore, that the calves were not as well developed at the conclusion of the trial as those in Experiment 1.

From figs. III. and IV. it will be noticed that, taking into consideration their smaller size at birth compared with the Experiment 1 calves, satisfactory growth was made during the first 90 days of the experiment. During the last 90 days, however, there was a definite decrease in rate of growth both in weight and in height. This decrease was due to the fact that after the feeding of whole milk was discontinued, great difficulty was experienced in getting the calves to eat sufficient concentrates (see Table V.). In addition Calf No. 63 suffered from a mild attack of anaplasmosis during the 4th and 5th months of the experiment.

*Suffered from anaplasmosis during 4th and 5th months.

†Eckles' (1920) normal growth data for pure bred Frieslands (Holsteins).

Although the calves apparently did not make normal growth when compared with Eckles' Normal Growth data and did not do as well as the Experiment 1 calves, they had a sleek, thrifty appearance at the conclusion of the experiment, and were considered well grown for their ages by experienced cattlemen. Their development since the conclusion of the trial has shown that they will grow into as satisfactory cows as the Experiment 1 calves.

Table V.—Average monthly consumption of concentrates and hay.

Month	Concentrates lbs	Hay lbs.
1st	9	13
2nd	37	55
3rd	74	110
4th	81	136
5th	111	158
6th	138	177

Table VI.—Average amount of feed consumed and feed cost per calf up to 180 days of age.

Whole milk from 5 days of age.	Concentrates	Hay.	Feed cost per calf *
408 lbs.	450 lbs.	649 lbs.	£2 10 6

From Table VI. it will be noticed that the calves consumed on the average 408 lbs. of whole milk, 450 lbs. of concentrates and 649 lbs. of hay. The consumption of concentrates is definitely low and, as pointed out previously, is no doubt partly responsible for the slower growth during the last three months of the experiment. The calves consumed on the average 227 lbs. milk and 82 lbs. concentrates less and 293 lbs. hay more than the Experiment 1 calves.

In view of the fact that satisfactory growth was made during the first 90 days of the experiment it is considered

*Whole milk 6d. per gallon; lucerne hay, £2; maize meal, £5; peanut meal, £7 10s.: bran, £6; bloodmeal, £8; di-calcium phosphate, £15; salt, £3 10s. 0d. per ton.

that the milk allowance (408 lbs.) was adequate and the schedule followed satisfactory.

The total feed cost per calf up to 180 days of age was £2 10s. 6d., and of this amount the whole milk accounted for 40% and the concentrates and hay for 60%. These costs should be considered very low.

SUMMARY.

During a period of 180 days the Ayrshire X Grade Friesland calves in Experiment 2 consumed a total of 408 lbs. of whole milk, 450 lbs. of concentrates and 649 lbs. of hay. The whole milk was fed from the 5th to the 56th day.

The ration proved satisfactory from a growth point of view.

The feed cost per calf amounted to £2 10s. 6d., and of this amount the whole milk accounted for 40% and the concentrates and hay for 60%.

From the practical point of view the ration fed to the calves in Experiment 2 proved efficient and considerably more economical than that fed in Experiment 1. A saving of 13s. 6d. per calf was effected.

ACKNOWLEDGEMENTS.

I am indebted to Dr. D. G. Haylett, Director of the Matopo School of Agriculture, for providing the necessary facilities for carrying out the experiments; to Dr. A. E. Romyn, Chief Animal Husbandry Officer, for technical advice and assistance throughout the experiments and assistance with the preparation of this report; to Mr. R. H. Greaves, Stockman, for regularly weighing and measuring the animals and supervising the feeding.

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SOIL EROSION.

By P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E.,
Irrigation Engineer (Matabeleland).

An article on soil erosion was published in this Journal in April, 1929, and reprinted as Departmental Bulletin, No. 735.

Since the date of publication of the article, further experience in the matter of the prevention and control of soil erosion has been gained, and it is now considered advisable to reprint the article embodying such changes in policy and methods as have resulted from the increased knowledge of the subject in relation to this Colony.

Owing to the world-wide use of the term "ridge terrace" it is considered advisable that the term should be adopted in this Colony also, in place of the term "contour ridge" which has hitherto been made use of. It should be noted therefore that all reference to "ridge terraces" in this article deals with the constructions previously referred to as "contour ridges."

It is of interest to note the progress made in combating soil erosion on cultivated lands since 1929, and the following figures, based on works actually set out by this Division, are submitted.

Year.	Miles of Ridge Terraces pegged out.	Area of Land Protected in (acres).
1929	76	2,280
1930	103	3,090
1931	150	4,500
1932	108	3,240
1933	132	3,960
Totals	569 miles	17,070 acres

In this connection, however, it must be pointed out that the total acreage of land under summer crops in this Colony is some 382,000 acres, and of this acreage only about $4\frac{1}{2}\%$ of the area is protected against erosion.

It is essential that still greater efforts be made to conserve our soils, and further, that the necessary steps be taken NOW.

For the benefit of those who may not have a knowledge of how erosion occurs, the following brief description is given of the general natural erosion which has been taking place since time began.

General Natural Erosion.—Erosion may be simply explained as the breaking down of the materials forming the surface of the earth and the movement of such material from one place to another. The breaking down or weathering of the earth's surface is caused by the agencies of temperature changes, wind and water, and it is with the two last named that the farmer has to deal. All land surface areas pass through a cycle of general erosion which results in the appearance of the physical features with which one is familiar. An example will explain how this happens. A plain is elevated above the general level of the surrounding country, possibly by plutonic activity, and this plain is in an undenuded or uneroded state. Gradually, as a result of the drainage of rainwater, the small gulleys are formed, which slowly but steadily increase in size until the original plain becomes a mass of hills and valleys. The hills, being of a harder formation, resist more strongly the weathering forces waging war with them, but in the course of time they are destroyed, and a plain results once more. A plain resulting from such action would probably consist of good agricultural soil, but those portions of such a plain which had originally been hills would probably, for a great number of centuries, be quite unsuitable for growing crops. This is what happens to cultivated lands, and to a lesser degree uncultivated lands, when erosion takes place. Small hills and valleys are formed, the hills being actually ridges in a field, and the valleys the small gulleys and depressions so often occurring on cropped lands.

An examination of the growth of a valley is also enlightening. A small gulley or slight depression is first

formed, and owing to the increase in the speed of the water as it drops into and runs down this gulley, the sides are eroded and the gulley widens and deepens. At the same time the head of the gulley gradually creeps back and up the prevailing slope until the bed reaches a base level which increases in size till the whole area is base-levelled and a flat or plain results.

This is occurring daily on a smaller scale on cultivated lands where nothing has been done to prevent soil erosion.

Æolian Erosion.—As well as water, wind is also an agent working for nature in the group of eroding agents. Such erosion by wind is termed æolian erosion.

The transportation of dust by wind is well known, and the fineness of the particles transported is recognisable by the fact that dust is deposited in every place to which a current of air has access. The removal of sand as well as the fine dust also occurs to a marked extent in many localities, particularly in the more arid districts where the vegetal covering of the land is thin. Moisture, by increasing the cohesion of the particles of earth, prevents their being removed by wind action, and so the maintenance of a good water content in the soil is highly important in preventing æolian erosion.

Evaporation.—Evaporation has a direct bearing on the moisture content of the soil, and a few remarks on this will be useful.

The annual evaporation from a free water surface in this country is, on the average, nearly 8 feet. In California, where conditions are similar to those obtaining here, the evaporation from saturated sandy loam has been found to be at least twice the amount from a free water surface. With soils containing a smaller amount of moisture the evaporation, although much less, is nevertheless of practical magnitude.

As moisture helps to bind the particles of earth together, it is highly important that the moisture content should be maintained. Water is drawn to the surface from below by what is termed "capillary attraction," the paths followed by such water being called "capillary tubes." In order to

prevent or reduce this drawing up, the capillary tubes must be broken up, and one of the best methods of doing this is by the maintenance of a good mulch on cultivated lands.

On lands such as pasture lands, which are not annually cropped, a good vegetal covering will reduce the evaporation by shading the soil, keeping it cool and protecting it from the drying action of the wind. The further effects of vegetation will be seen later.

Erosion by Water.— Examples of erosion by water have already been given in the general description of the natural erosion which is continually taking place, but it is difficult to appreciate the extent of this on farming lands, without considering such factors as silt in rivers, the run-off of storm water after rains and the effects of vegetation.

Silt.— The load carried by running water consists of two parts—(*a*) silt, and (*b*) pebbles and boulders. Silt is the very fine earthy material carried in suspension in the water, and although it has a tendency to fall towards the bottom of a stream or gulley bed, it is prevented from doing so on account of the smallness of the particles, which allows them to be lifted up by the numerous eddies always present in a rapidly flowing stream of water. The amount of silt transported by a given quantity of water flowing at any given speed is, however, to an extent limited, as every increase in the stream's load causes a corresponding decrease in its carrying capacity.

The larger bodies, such as pebbles and boulders, are rolled along at the bottom and help to erode the bed still more. In this connection it is interesting to note that it requires a stream velocity of only $3\frac{1}{2}$ feet per second to transport pebbles 1 inch in diameter.

As regards the quantity of silt carried in the rivers in this Colony, a few observations have been made on one or two rivers, and it would appear that about $\frac{1}{4}$ *inch of soil is lost annually from cultivated land* in the Mazoe district. In years of heavy rainfall this amount will be much greater. The writer himself has seen on a certain farm a land which had been under cultivation for some 20 odd years, and which,

owing to the non-existence of soil conservation works, had been denuded of practically the whole of the top surface. The original yield of maize from this land was 20 bags per acre; the yield at the time of inspection had dropped to 4 bags of maize per acre. Green cropping and the use of artificial fertilisers had been resorted to, but no good had resulted, owing to the annual washing away of the soil and fertiliser.

From observations on land prepared for tobacco, but on which no crop had yet been planted, it was found that every $6\frac{1}{4}$ gallons of water which flowed off removed with it nearly $2\frac{3}{4}$ lbs. of silt containing more than $5\frac{1}{2}$ ounces of organic matter.

With a rainfall of $1\frac{1}{2}$ inches in $1\frac{1}{2}$ hours it is probable that more than $1\frac{1}{2}$ tons of soil containing 460 lbs. of organic matter was washed off *each acre* of this land.

The transporting power of water is high, and increases with the velocity at which the water travels. This transporting power varies as the sixth power of the velocity, which means that if a stream of water travelling with a certain initial velocity is just able to move a particle of a particular size, the same stream, travelling at twice its original velocity will be capable of moving a particle 64 times are large as that moved in the first instance.

When water enters a depression its velocity is increased, and as a natural result its destructive power becomes much greater, which accounts for the rapid growth of gulleys and washouts.

Run-off of Storm Water.—The percentage of the water falling on the land which runs off in the form of storm water is high, particularly when the ground in the locality where the rain occurs is already saturated.

The amount of run-off depends on the following factors:—

(1) The distribution and amount of the rainfall in a catchment. In dealing with individual farms, the distribution is, for all practical purposes, equal over the whole area, and the amount becomes more important.

(2) The average slope of the catchment.

(3) The nature of the catchment, that is, whether it is cultivated land, has a porous or tight soil, and whether the soil is deep or shallow.

(4) The nature of the covering, such as crop, grass, bush, etc.

(5) Whether the catchment is saturated or not.

In dealing with soil erosion one must be prepared for the average worst conditions, and consequently it is necessary to consider the catchment as being saturated. The amount of run-off on a small catchment area may be appreciated by a study of the run-off figures for the Cleveland Dam, Salisbury. The size of the catchment is seven square miles, and consists of gently sloping grassed country with a sandy soil. The saturation point of this area occurs after a total rainfall of about 20 inches.

In the 1925-26 season the highest percentage storm run-off which occurred was 72.45 per cent. of the rain which fell, and the average between 1st October and the 31st March was about 24 per cent. Accepting a percentage run-off of 24 per cent., the amount of water which would flow off ten acres of land after a 3 inch rain would be 162,000 gallons. The run-off from cultivated land will be less than the above, but assuming that only 12 per cent. of a 3 inch rain runs off, the total from ten acres will be 81,000 gallons. With a run-off of 36 per cent., that is half the maximum percentage run-off from the Cleveland Dam catchment in 1925-26, from ten acres 243,000 gallons will wash over the land.

Effects of Vegetation.—It must be evident therefore that erosion is a danger which must be dealt with rapidly and effectively, unless one is content to allow the country to develop into an arid waste in a very short time. *The encouragement of the growth of vegetation will effect a very great deal in preventing erosion* and also in helping to reclaim denuded areas. Vegetation, as stated before, reduces evaporation by diminishing the wind action and by shading the soil. A good vegetal cover also helps considerably in binding the soil together. One may frequently observe the

effect which a single plant root has in reducing the rate of growth of a small gulley. Walk along any washed-out depression in the veld and you will almost certainly come across examples of this. Another beneficial result from a good cover of vegetation is the increase in moisture in the soil and later the increased supply of underground water which is the outcome of this. This is effected in two ways. First, there will be a large amount of root growth, and as each root affords a path down which the water can find its way below the ground surface, there will be a large area of entry. Secondly, the vegetation itself checks the flow of water, and thus increases the time of contact between the earth and the water flowing over it, thus enabling a greater amount of water to be absorbed.

The run-off from heavily grassed areas is always far less than from unprotected soils. It has been proved that the moisture content of grassed soils may be as much as sixteen times the moisture content of similar soils which have suffered from erosion.

Methods for Prevention and Reclamation.—Having stated briefly how erosion takes place and what effects it has, it remains to be explained how it may be prevented and what measures must be adopted to reclaim eroded land. In the first place, it will be advisable to consider the land which is not being cropped annually, that is, pasture and unused veld land.

Veld Burning and Bush Cutting.—One is here faced with the ever-recurring question, "To burn or not to burn?" It can be stated that, with very few exceptions, it is definitely harmful to practise grass burning. Burning destroys the decayed or decaying vegetable matter which under natural conditions would form humus; it destroys the seeds of the finer grazing grasses, and in bush country it does incalculable harm to trees and bushes, which, although they may not be killed, will suffer greatly from a retardation of growth. The sight of new green grass which appears after burning leads many farmers astray in thinking that the growth is due to the burning. The new growth is present even if the grass is not burnt, and unless it is in order to enable cattle to get at this new grass, because there is no other feed, there is no reasonable excuse for burning. Grass burning has a direct

deteriorating effect on the grazing value of the veld. Paddocking will improve the vegetation, by permitting of easy rotation of grazing areas, and this should be resorted to. *Graze or cut the grass; do not burn it.*

As regards the bush cutting which goes on annually, here again the thoughtless person is joining forces with the warring armies of erosion. One admits that trees must be cut for fuel and buildings, but it is within the power of every farmer to reafforest such areas which have been denuded of trees. A progressive policy in afforestation will repay the individual handsomely in every case.

Over-stocking.—Overstocking is dangerous in the extreme and leads at once to over-grazing, which in its turn leads to soil erosion. The solution to over-grazing is paddocking, and the provision of adequate water supplies. If water supplies are few and far between, the cattle will over-graze the land in the immediate vicinity of the water. The water supply problem may be solved by boreholes, wells and dams, *but remember—the amount of underground water and the existence of perennial streams depend directly on the control of erosion.* If all the rain which falls on the land is permitted to rush off in the form of storm water, there will be no perennial streams, and the level of the underground water will drop to such an extent that underground supplies will become so expensive to obtain as to be beyond the means of the average farmer.

In paddocking, the paddocks should be so arranged that the movement of cattle from one grazing area to another can be effected along routes running in a direction transverse to the drainage slope of the country. Cattle tracks forms an ever-ready source of gulley formation, and consequently must be watched, and their number reduced to a minimum. The planting of trees in paddocks will reduce erosion, and incidentally furnish shade for the cattle.

Roads and Paths.—The presence of good roads on the farms in this country is the exception rather than the rule, and it is to be deplored that the average farmer cannot recognise their necessity. *Bad roads are a potential source of danger as regards soil erosion,* but this fact does not appear to enter the

mind of the farming community. Special reference should also be made to the type of road used by miners and farmers for wood cutting. Such roads are often abandoned, and left to wash out into deep and dangerous gulleys, which are one of the most serious factors in causing erosion. An ever recurring question is how a gulley resulting from a badly drained road may be reclaimed. A cure is not nearly as satisfactory as a preventative, and it is invariably more expensive. All roads must be properly drained if the farmer does not wish to be faced with the necessity of reclaiming dongas and gulleys; a camber must be given to the road surface, and, at the first appearance of wash, steps must be immediately taken to prevent further erosion.

The side drains along roads must be of such dimensions that all the water, which otherwise would flow on to the road from land above it, is carried away. The drain on to the top-side of a road must necessarily be larger than that on the lower side, and the spoil must be deposited between the drain and the road, or else utilised in making up the road surface.

Suitable sizes of drains for roads may be taken from the tables of sizes of storm drains given further on. On steep land, drains must be stepped down, and the steps protected against erosion by being constructed of brick, masonry or concrete.

Road drains must discharge at suitable points along their course, and advantage should be taken of all natural drainage channels for this purpose. If drains are discharged on to the veld, suitable places such as rocky outcrops and heavily bushed and grassed areas should be chosen as discharge points.

PROTECTION OF CULTIVATED LANDS.

Having described the methods by which the general veld erosion may be prevented, it is now necessary to deal with the erosion or denudation of cultivated lands. In order to prevent this it is an essential that money be spent on the necessary works. Mention of expense, it is feared, will harden the hearts of many farmers, but a study of the economic side of the matter should relieve their minds of the idea that it is anything but a sound economic business investment.

The "ridge terracing" of cultivated lands described further on, together with the provision of the necessary storm drains which protect the lands and carry off the discharge from the ridges, has been found to entail an average expenditure of 7/6 per acre. In many cases the cost has been less than this figure. The amount of 7/6 per acre for *complete protection* is not high for soil conservation works, and the increased yield from lands so protected will pay for the expenditure in a comparatively short period, and will result in an increase in the value of the farm, much in excess of the capital expended.

Sound investments result in financial stability. *Money spent on soil conservation works is money invested wisely.*

It must be borne in mind that the greater the volume of water flowing over the land the greater will be the erosion resulting.

The results of unchecked erosion are:—

1. Formation of channels through the land, commencing as small wash-outs and later developing into unsightly gullies, with the consequent disappearance of soil.
2. The leaching out from the soil of chemical salts necessary for successful propagation of crops.
3. Disappearance of the humus in the soil and continual appearance of fresh sub-soil on the surface of the land.

This sub-soil never has time to gain the properties needful for the growing of crops, as it annually disappears and a lower stratum of earth is exposed.

The results may be briefly stated as *the inability of the soil to produce crops and the resultant depreciation of the value of the land.* This immediately raises the question of protection against soil washing or denudation.

The problem to be solved may be divided into two heads:

(*a*) prevention of large volumes of storm water from passing over the land;

(*b*) the prevention of an accelerated run-off, due to slope of land and increasing volume of water.

The question of protection is one which requires a great deal of thought and experience, and the methods recommended are based on practical experience.

Storm Drains.—Before measures can be adopted to prevent the denudation or washing off of the soil on cultivated lands by the water falling on the lands themselves, steps must be taken to prevent the access on to the land of storm water from outside areas. The only effective method of doing this is by the construction of storm water drains of adequate size at the heads and sides of all lands. The fault to be found with most farmers is that they almost invariably under-estimate the intensity of run-off of storm water after rain. A rainfall of 2 inches in 1½ hours, which is anything but exceptional, can produce a run-off of 300 cusecs or 1,900 gallons per second per square miles of catchment. Therefore it is essential that storm drains capable of dealing with this amount of water be provided.

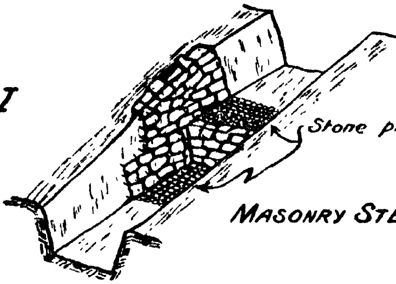
This run-off is not in any way out of the ordinary; in fact, intensities of rainfall up to 4½ inches in 1½ hours have been experienced. Further, the percentage of run-off from hills in granite areas is very often so high as to account for a run-off up to 400 cusecs per square mile of catchment.

These figures should serve to show the absolute necessity for constructing what may be considered large storm drains.

The construction of a drain which will not carry off the normal run-off is wasted labour, time and money. The consequences are disastrous to the lands which the drains were originally intended to protect. An overflow takes place, the drain bursts and a large volume of water concentrated into one stream pours down the land, forming a gulley, which it is extremely difficult to prevent from rapidly increasing in size.

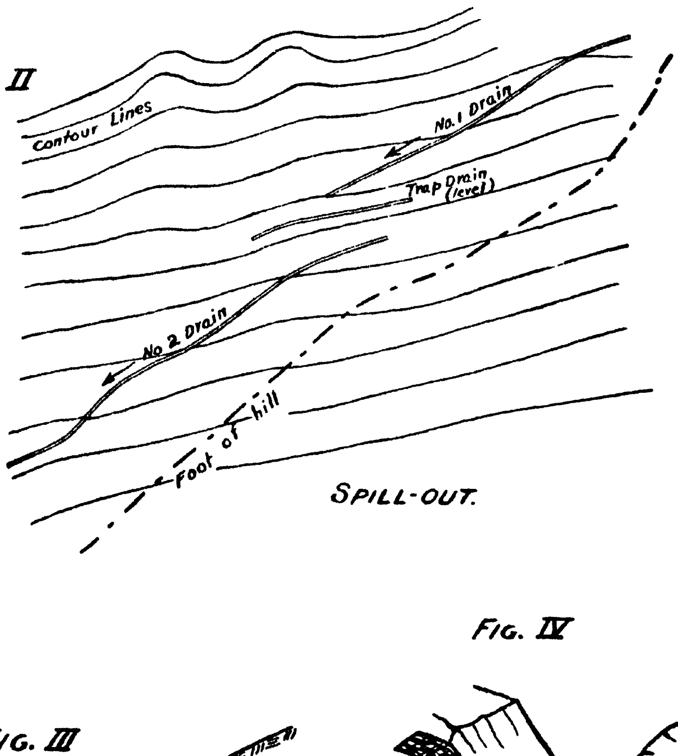
Utilisation of Natural Water Courses.—In order to reduce the strain on artificial storm drains, natural water courses should be made use of as far as possible. *These should not be ploughed up, and the natural vegetation should be left undisturbed.* Admittedly, in appearance, it is very fine to see a large unbroken stretch of ploughed land, and further, in practice, ploughing over long distances is a little less costly

FIG. I



MASONRY STEP IN DRAIN.

FIG. II

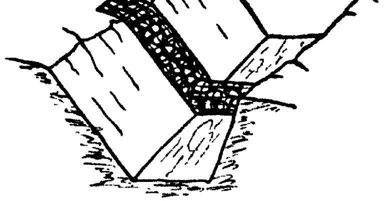


SPILL-OUT.

FIG. III

DRAIN WITH SLOPING BED.

FIG. IV



BOULDER-NET WORK IN DONGA.

on account of more rapid work being possible, but it is far better to sacrifice the few acres of land occupied by the natural water course than to go to the expense of constructing an abnormally large artificial drain.

The natural water course does not erode to any noticeable extent if the volume of water passed down it does not exceed that which is carried off under natural conditions. This is the limiting factor for the use of natural water courses, unless additional artificial protection is resorted to.

Grades and Sizes of Drains.—The correct grading of storm drains is a matter which has to be carefully considered before any decision is come to.

On loose friable soils, which are liable to scour under the action of water, a fairly flat grade must be adopted; with harder types of formation a steeper grade can be used. On the softer formations the grade should not be steeper than 1 in 300, otherwise the scouring effect of the storm water will result in the formation of gullies.

In very hard ground the grade may be steepened to 1 in 200, but before adopting this steeper grade it must be definitely ascertained whether the formation will successfully withstand excessive scouring action.

Only in the cases of the hardest rocky formation should a grade steeper than 1 in 200 be adopted.

Where drains have to be carried down steeply sloping land it is necessary that they be "stepped" down at intervals in order to preserve a non-scouring grade. The steps must be protected by means of stone pitching, masonry or concrete.

Fig. 1 shows a step constructed in masonry and stone-pitching. It will be seen that the sides are protected as well as the lip and bottom of the fall; this is very essential as otherwise the sides would erode and the step ultimately collapse.

A temporary form of protection can be constructed with stakes, interwoven with grass and branches, but it is not good practice and in the end entails increased expenditure when the permanent form of construction is carried out.

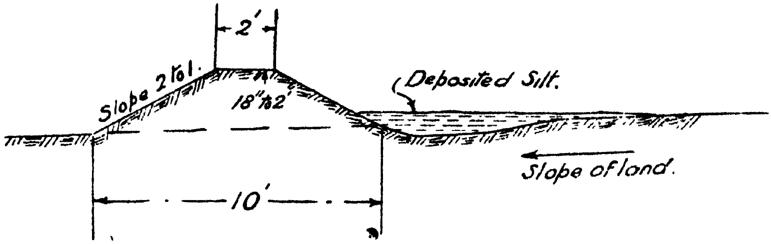
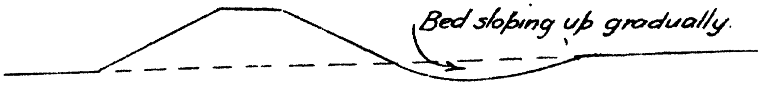
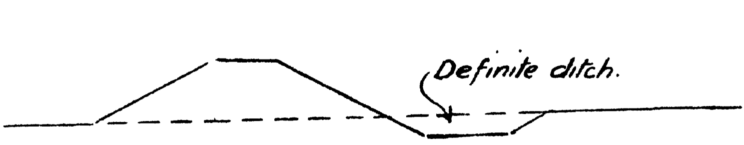


Fig. V



Correct method.



Incorrect method.

Fig VI

In running a drain round the foot of a hill the actual slope along the route is frequently found to be very much greater than the proposed slope of the bed of the storm drain. In order to preserve the grade of the latter, steps must be constructed, or some other method of disposing of fall adopted. If the hill itself is sufficiently stony and hard, this disposal of fall may be effected by means of spill-outs. The drain is carried on a down grade till it commences to get away from the foot of the hill. The drain then terminates on natural ground level, and the water spilling out is picked up by a drain starting on a lower level. The end of the first length and the beginning of the second length must overlap. Further, an additional short length of level drain must be placed between the two so that it overlaps the end of the one drain and the beginning of the other. This short length serves as a trap for detritus and rubble carried in the drain itself. The velocity of the water spilling out from one drain is checked as the water reaches the trap drain, and all rubble is deposited, allowing storm water only to flow into the second length of drain.

When the trap drains are constructed the spoil should be placed some distance away so as not to interfere with the flow of water. The trap drains require to be cleaned out periodically, and the rubble, etc., taken out, should also be deposited at some point well away from the drains. The storm water should enter and flow out from the trap drain as a thin sheet and should not be concentrated at a point.

This method entails the making of longer drains, but on very steep ground it will be found more economical than the construction of steps at very short intervals. Fig. II. shows the spill-out method.

In all storm drains the bed of the drain should slope down towards the hill, in order to concentrate any scour taking place, on the side better able to stand it. Fig. III. explains this.

Table I. below gives the approximate dimensions of storm drains necessary for catchments of different sizes, and it must be emphasised very strongly that these dimensions are *not* on the large size.

TABLE I.

Grade	Total Area of Catchment		Bed Width	Top Width	Minimum Depth
	Acres	Square Miles			
1 in 300	80	$\frac{1}{8}$	4ft. 0in.	5ft. 10in.	1ft. 10in.
	160	$\frac{1}{4}$	6ft. 0in.	7ft. 10in.	1ft. 10in.
	320	$\frac{1}{2}$	9ft. 6in.	11ft. 6in.	2ft. 0in.
	640	1	15ft. 0in.	17ft. 5in.	2ft. 5in.
	960	$1\frac{1}{2}$	20ft. 0in.	22ft. 8in.	2ft. 8in.
1 in 200	80	$\frac{1}{8}$	4ft. 0in.	5ft. 5in.	1ft. 5in.
	160	$\frac{1}{4}$	7ft. 0in.	8ft. 5in.	1ft. 5in.
	320	$\frac{1}{2}$	9ft. 0in.	10ft. 10in.	1ft. 10in.
	640	1	15ft. 0in.	17ft. 0in.	2ft. 0in.
	960	$1\frac{1}{2}$	20ft. 0in.	22ft. 3in.	2ft. 3in.
1 in 100	80	$\frac{1}{8}$	4ft. 0in.	5ft. 2in.	1ft. 2in.
	160	$\frac{1}{4}$	7ft. 0in.	8ft. 2in.	1ft. 2in.
	320	$\frac{1}{2}$	9ft. 0in.	10ft. 4in.	1ft. 4in.

The drains have been so designed as to permit of a full flood rising partly up the spoil bank. This has been done in order to save the cost of excavation. As a result of this it is *highly important* that the spoil bank should be constructed and *maintained* in a well consolidated and protected condition.

It is good practice to plant the spoil bank, formed of the excavated material placed on the lower side of the drain, with protective vegetation which will bind the earth and prevent it from being washed away. A suitable growth is "sisal," which will in time mat closely together and form a hedge.

Where storm drains cross gulleys leading from hills a strong construction is necessary. It is advisable to build small earth dams across such gulleys, discharging the water from

the one section of drain into the basin so formed, and leading off the water again in the next section. In time these gulleys will become silted up to the level of the bed of the drain.

It is advisable to construct these small dams very carefully.

The site must be cleared of all roots, grass and organic matter, which must be thrown away. The earth used should be a good medium loam wherever possible, and should be placed in layers not more than 6 inches thick. Each layer should be well consolidated by rolling, ramming or walking stock over it. Before the next layer is placed the surface of the work must be roughened by raking or some other method and then wetted. A tight junction between consecutive layers must be obtained. The layers should be placed not dead horizontal but with a slight fall from each end towards the centre.

For walls under 8 feet in height the top width must be at least 4 feet, and between 8 feet and 15 feet in height the top width must be at least 6 feet. The side slopes must not be steeper than 2 to 1, *i.e.*, 1 foot vertical to each 2 feet. horizontal. Care must be taken to effect a tight bond between the natural sides of the gulley being crossed and the artificial bank. The embankment should be planted with grass after completion.

The cheapest method of constructing storm drains is to first roughly plough them out, using as heavy a plough as possible, and then to finish off the work with hand labour. In some cases, of course, it will not be possible to utilise a plough, and hand labour only will have to be resorted to. Piece work will be found to be the most satisfactory allocation of work, and as a guide to the quantity of material which can be excavated by an adult male native the following practical figures are given. The excavation is assumed to be in ordinary earth, and it should be realised that with a uniform depth the wider the drain the less will be the quantity excavated, owing to the fact that the spoil will have to be thrown further.

Size of drain.	Length excavated per native per diem.	Quantity excavated per native per diem.
4 ft. by 2 ft. deep	13 ft.	104 cub. ft.
6 ,, 2 ,,	8 ,,	96 ,,
10 ,, 2 ,,	4 ,,	80 ,,
12 ,, 2 ,,	3 ,,	72 ,,

Should the material excavated be gravel, the amount of excavation per native per diem must be reduced accordingly. A reduction of about 10 per cent. in this case should be reasonable, but practical experience will prove whether this is so.

In laying out the work it is best to supply the natives with sticks for measuring the correct depth to be excavated to. It will be found convenient to peg off both sides of the drain when allotting work. It is usually found that natives appreciate excavation work as a change to the usual routine, but it is unwise to keep them on this type of work for too long a period.

Where a drain changes direction, easy curves must be constructed, and it will be found advantageous to increase the width of the drain slightly at these points. Storm drains must be inspected periodically and should be repaired and cleaned out every year just before the advent of rains. It is most necessary that new drains should be examined during or immediately after the first heavy fall of rain. It is better to inspect during the actual flow of water, as small undesirable deviations from the correct construction will be more obvious then.

The spoil or excavated material must be thrown on the lower side, and a berm or path should be left between the drain and the spoil bank; the spoil bank should be well consolidated.

Remember, in all drain work, that if any doubt exist as to the correct size of drain, increase it beyond what may be thought sufficient, and never reduce it in size.

Where wagon and implement crossings are necessary these should be dished out and paved with stone pitching, both in the bottom and up the sides.

Ridge Terraces.—Undoubtedly the most efficient method of preventing washing on cultivated lands, having regard to the costs of soil conservation, is by the adoption of ridge terracing.

As stated previously, the greater the volume of water flowing over land, the greater will be the erosion. The one object attained by ridge terracing is the division, into small controllable volumes, of the total water flowing off cultivated lands, and the second object is the collection of silt behind the ridges.

Ridge terraces may be briefly described as long, low mounds of earth running on a grade across the slope of the land, behind which the silt collects and the surplus storm water drains off. Illustrations of a ridge terrace are shown in the accompanying illustration.

The efficiency of ridge terracing can best be proved by figures, and the following results obtained on a farm in the Mazoe district are enlightening.

The silt content of water flowing off a tobacco land before it reached a ridge terrace was found to be 41.7 ounces of silt per cubic foot of water ($6\frac{1}{4}$ gallons) and this silt contained $5\frac{1}{2}$ ounces of organic matter.

At the outlet of the ridge the water was found to contain only 5.6 ounces of silt and a little less than $1\frac{1}{8}$ ounces of organic matter.

In this instance then the ridge saved 36.1 ounces of silt in every cubic foot of water and was thus efficient to an extent of $86\frac{1}{2}$ per cent. The efficiency as regards saving in organic matter was 80 per cent.

On another land the efficiency of ridge terracing was found to be 56 per cent. as regards silt saving.

Observations were made on maize lands also and here again very excellent efficiencies were obtained.

In general, it was found that the result of silt-laden water passing along 200 yards of ridge was the retention of anything from 45 per cent. to 80 per cent. of the silt carried.

It will thus be seen that the efficacy of ridge terracing is one of very practical value.

Land Requiring Ridge Terracing.—Almost without exception all land with a slope steeper than 1 in 40 will require contour ridging, and it is found that the greater portion of the rich arable lands in this Colony have slopes much in excess of this. In many parts farming operations are carried out on lands with an average slope of 1 in 15 to 1 in 20, and erosion is taking place in these areas to a marked extent. Soil washing may not be apparent to the casual observer, but to the experienced person the results of the evil are readily noticeable. Instances are common of the drop in crop yield, actually due to denudation, being placed at the door of inefficient fertilising and other causes. It must be obvious that the improvement of soils by means of artificial fertilisers, green manuring and other methods can never prove successful as long as water is permitted to remove the surface soil from cultivated lands.

Details of Ridges.—A cross section of a ridge terrace is shown in Fig. VI., and in Fig. V. a typical lay-out of a land with ridge terraces and storm drains is shown in plan.

Ridges should be constructed with a final height of 18 inches to 2 feet, a top width of 2 feet and a base width of about 10 feet. A base width of 8 feet may be employed for ridges 18 inches high, but the broader based construction is without doubt more efficient.

Grades and Distances Apart.—Experience has shewn generally that the flatter the grades on which ridge terraces are constructed, the more efficient they are. With very flat grades, however, the ridges require to be considerably increased in height as the water flows off more slowly.

From observations made it is now considered that the most suitable general grade to adopt is 1 in 400, although further research may show that much flatter grades will prove effective.

The heavier the absorptive powers of a soil the flatter can be the grade, but the farmer is not advised to construct ridges on a grade flatter than 1 in 400 without first having the lands inspected by an engineer of the Irrigation Division.

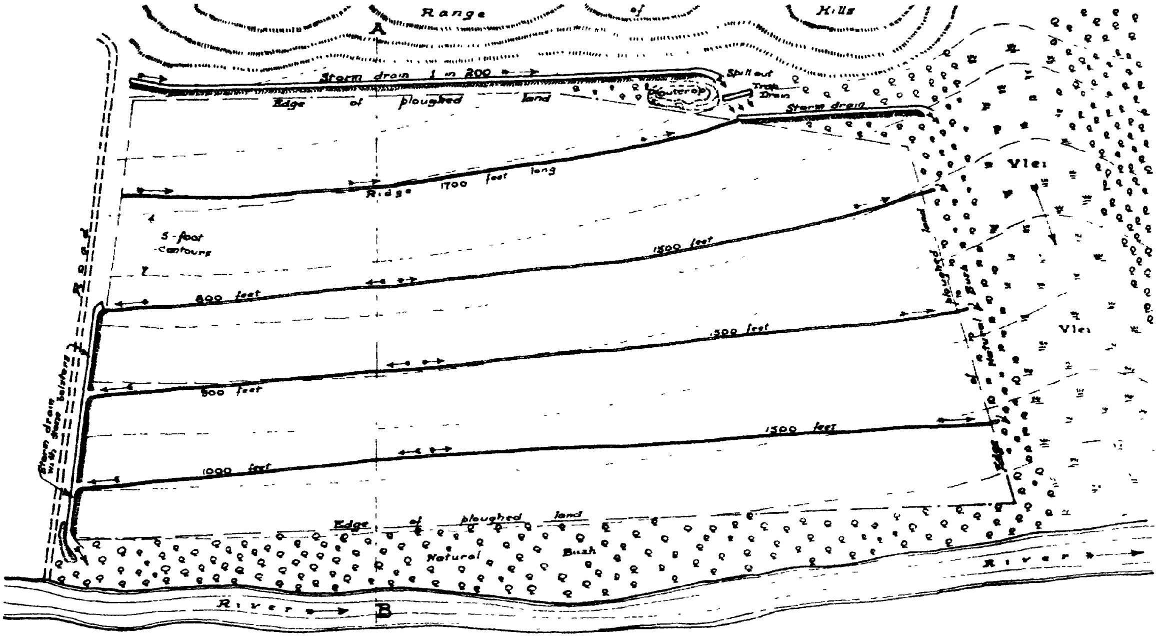
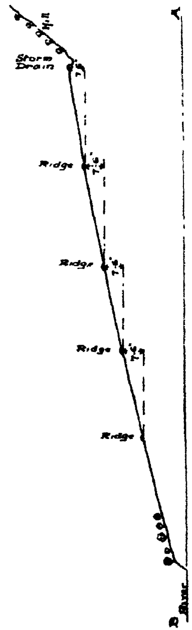


FIG V

Contour plan of typical land (60 acres) showing system of storm-drains and ridges



SECTION ON LINE AB

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May 1934

The distance between successive ridges is an important point to be considered, and under no circumstances should they be spaced further apart than 100 yards. On steeply sloping lands they require to be set at closer intervals than this.

In general it is advised that the ridges be placed at such distances apart that the vertical fall between consecutive ridges is 7 feet 6 inches.

The following table may be used as a general guide to the spacing to be selected:—

Slope of Land.	Distance between successive Ridges
1 in 40	100 yards.
1 in 30	75 ,,
1 in 20	50 ,,
1 in 15	35 ,,

The ideal would be to place ridges at such a distance apart that the toe of one ridge is approximately at the same level, or slightly above, the top of the next lower ridge. In practice, however, this is not usually possible, unless ridges are constructed very close together with a consequent increase in the cost of farming operations.

Provided very great care is taken the location of ridges may be decided upon, in many cases, by an examination of the effects of erosion which has already occurred. As a rule small wash-outs, possibly 1 to 2 inches deep or more, are readily noticed before ploughing lands from which crops have been reaped. If such wash-outs are carefully traced to their sources a contour ridge placed a short distance above will usually be found to be located correctly, and the distance to be adopted between ridges will be the distance between the ridge so located and the storm drain at the head of the lands.

Length of Ridges.—Is is essential, for satisfactory operation, and to reduce the possibility of bursts occurring, that *no ridge should be longer than* 500 *yards*, if discharge is to take place at one end only. A ridge of a total length of up to 1,000 yards can be constructed if discharge takes place in both directions, provided that the discharge in any one direction does not occur over more than 500 yards.

As a general rule the longer the ridge the shorter must be the distance between ridges. The table of distances given under the preceding sub-heading applies to ridges of 1,200 to 1,500 feet in length, and if shorter ridges are made these distances could be somewhat increased.

The length of a ridge is also dependent upon the type and state of the soil, which has a direct influence on the amount of run-off occurring after rain; the less the absorbing power of the soil the shorter the ridges will have to be.

Setting out the Lines of the Ridges.—Ridge terraces are most conveniently set out by means of an engineer's level, and, should a farmer be so desirous, contour ridges and drains can be set out by an Engineer of the Irrigation Division.

The most convenient method of staking out is to place pegs on the correct grade at distances apart of 100 feet. The grade location may be made on ground levels, care, however, being taken to ensure the foot of the staff being placed at the *average* ground level at each point. When pegging ridges on ploughed land this is most important. As each peg site is located the peg should be driven in so that that the top of the peg is at the height above the ground to which the completed ridge terrace must be constructed. If this is done, the top of all pegs will also be on the correct grade.

Having pegged out the ridge initially, it will often be found that very sharp angles occur in the pegged line, and awkward curves would result were this initial location to be adopted finally. An examination will show that by moving one or two pegs up or down the slope, easy curves may be obtained, and this may be done provided a cut behind the ridge is adopted or the ridge is raised, at the pegs which are moved. If a peg is moved up the slope, the ground behind the ridge line must be trenched down, and if a peg is moved down the slope, the bank must be raised. Such alterations are shown in Fig. IX. (*a*) and (*b*). In altering the position of a peg, the new peg must be placed with its top level with the top of the original peg which was placed on grade. The depth to trench is such a depth as will make the distance from the top of the peg to the bed of the cutting behind the peg the same as the height of a normal ridge above the ground level immediately behind.

When crossing depressions with a ridge, the bottom width of the bank must be increased in proportion to the increased height. Side slopes of 2 to 1 should be adhered to in all cases. Care must be taken to see that such high banks are placed on ground from which all vegetation has first been removed, all holes filled up and the whole surface roughened before the earth is placed.

An alternative method of pegging out is by means of an "A" frame as described in the article "Irrigation Canals," which appeared in the *Rhodesia Agricultural Journal* of January, 1928, and was reprinted as Bulletin No. 670.

Construction of Ridges.—For convenience in working it is advisable to place pegs in the ground where the upper and lower toes of the bank will start. That is, for a ridge 2 feet high with a total base width of 10 feet, short pegs are driven in the ground above and below the main location pegs and at a distance of 5 feet from the location pegs. This is illustrated in Fig. IX. (*c*) and applies only where no implements are used.

On a small scale, ridges are often made by hand labour only, the earth being shovelled into place. If the ground is hard, picks may be necessary as well. Construction is usually carried out on a "piece-work" basis, the daily task for each native varying from about 12 yards for hard ground to 30 yards or more in light sandy soil.

This type of construction is not economical on a large scale, especially if labour is scarce or expensive, and should only be employed when the natives can be spared from other work on the farm.

A quicker method of construction is by using a ditching-terracing implement of the type which has a cutting edge formed at the apex of two broad blades, by one of which the earth excavated is moved to one side. It is advisable to form the ridge of earth obtained from both above and below the location line, but rather more earth should be taken from the higher side, as this will be easily and rapidly replaced by the silt deposited behind the bank.

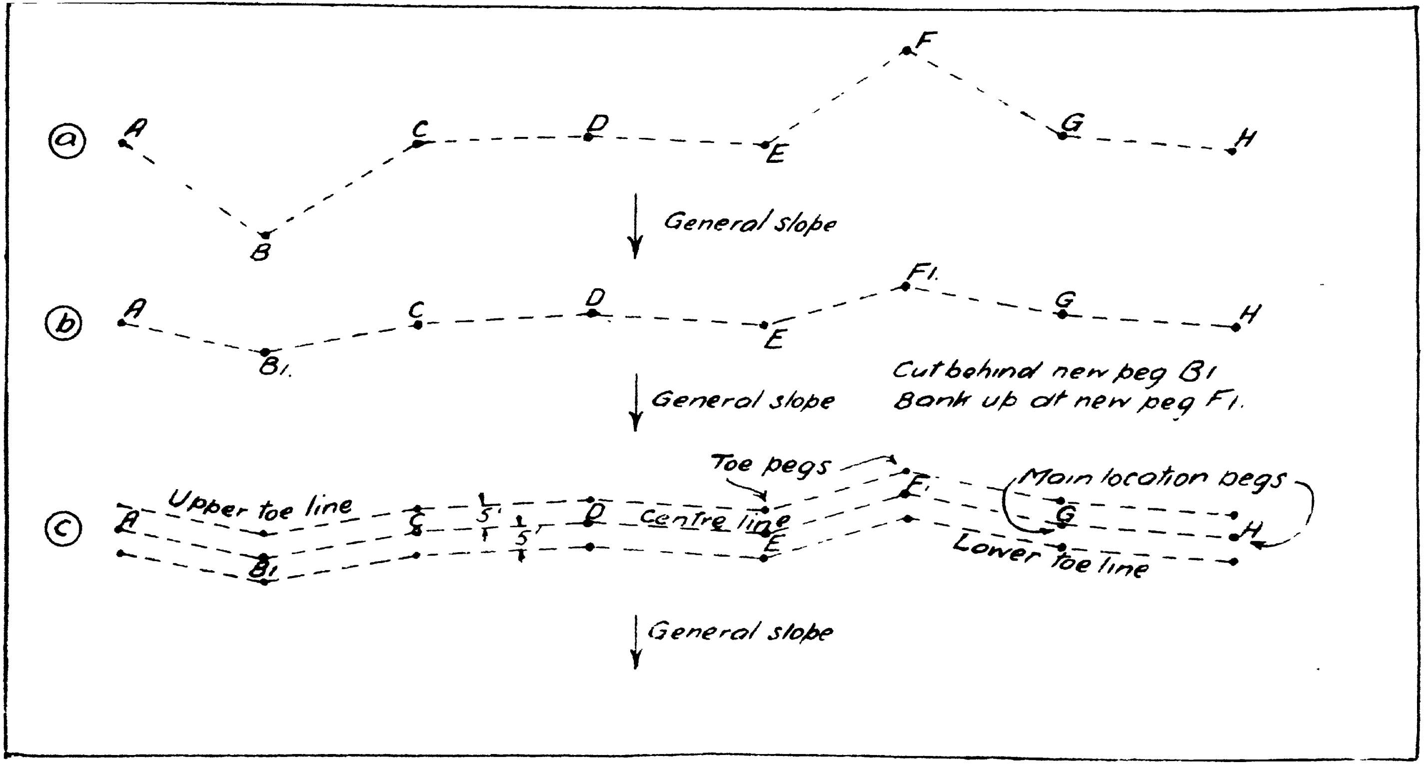

Fig. IX.

(a) Initial location. (b) Final location—pegs B and F moved to B1 and F1 (c) Final location, showing pegs marking toes of bank.

The first furrow should be cut about 12 feet above the upper toe line of the finished bank, and the earth thrown up is collected on its return journey by the ditcher which moves it, together with the next lot of earth, nearer the bank location. To begin with, the ditcher can be carried right round the ridge location, if the machine is reversible, that is, the implement first travels on the upper side of the locating pegs, turns at the end, and travels back along the lower side of the pegs.

A ditching implement speeds up the work, and does it well, provided the soil is soft and deeply ploughed, but it has several disadvantageous, namely:—

(*a*) it requires a fair amount of skill in operation;

(*b*) it tends to leave a deep, narrow trench next to the ridge, which does not easily silt up;

(*c*) it is an expensive implement to buy.

The dam-scraper is an implement the use of which in constructing ridges is rapidly and deservedly gaining popularity, owing to its cheapness and simplicity. The method which should be employed is as follows:—

After the ridge has been staked out a three-furrow plough should be run up and down two or three times on each side, in order to mark the line of pegs, taking care to maintain an even sweep as close to the pegs as possible. This operation should be closely supervised. If the land has not already been ploughed, the ploughing should be continued to cover a strip about 5 yards wide an each side of the line.

Four oxen are then yoked to a dam-scraper, which is worked at right angles to the line of the ridge. A good driver and leader are required, as well as a native to lift the scraper. The scraper should be lifted to take a fairly shallow cut, and when it reaches the line, it is thrown over to dump its load of earth. The oxen continue with the empty scraper for a few yards and are then turned sharply in order to scrape another load of earth on to the line of the ridge. This operation is continued and repeated until the ridge has reached its full size. Extra scraping will be required in gulleys and depres-

sions in order to make up the full height. The repeated trampling of the oxen over the earth already deposited results in a strong and well-consolidated bank.

If the oxen are changed every 3 hours, it is possible to construct 200 to 300 yards of ridge a day, and this method of construction is therefore very economical of lobaur.

The advantages of this method of construction may be briefly stated as follows:—

(*a*) most economical, both in first cost and operation (a dam-scraper can be bought for less than £4);

(*b*) readily understood and carried out by natives;

(*c*) is suitable for "piece-work" on a large scale;

(*d*) produces a strong bank;

(*e*) the ridge silts up more quickly, as the scraping is at right angles to the flow of water and there is no deep channel.

It is not possible completely to finish off a ridge terrace with a ditching implement or dam-scraper, and hand labour should always be used to trim the bank off.

When the bank is nearing its final height it is advisable to place short pegs in the earthwork between the main location pegs, and set the tops of these small trimming pegs on grade by means of "boning rods." The use of the "boning rod" is very simple. A "boning rod" is a "tee" made of two pieces of timber, the horizontal portion being of any convenient length, say 18 inches to 2 feet, and the vertical arm about 2 feet 6 inches to 3 feet in height. It is usual to use three "boning rods," and each one must be of exactly the same height. An illustration of their use is shown in Fig. X. A "boning rod" is placed on the top of each of two successive final location pegs and a sight taken over the horizontal shoulders. The third "rod" is set on the top of a trimming peg between the other two "rods" and the trimming peg knocked in till the shoulder of the intermediate "rod" is on the "line of sight." When this occurs the top of the trimming peg is on the same grade as the top of the final location pegs. The top of the ridge terrace is then brought up to the top of the trimming pegs.

All ridge terraces must be constructed of earth, well broken down, and no hard, solid lumps must be placed in the embankment. No stones or rocks must be embodied in the construction, as these form danger points, often permitting of the passage of water through the ridge.

In removing earth from the top side of the ridge care must be taken to *prevent a definite ditch being constructed,* and the bed behind the bank must slope gradually up to meet the natural ground surface. This is illustrated in Fig. VII.

It is imperative that no vegetation such as grass, tree stumps, etc., be placed in the earth bank, as such matter decays and leaves openings into which water may penetrate with the possibility of a burst occurring.

Crops on Ridges.—Almost any crop may be planted on the ridges and such crops may be permanent or annual. The majority of farmers prefer to plant a crop on the ridge similar to that growing between the ridges. It is not desirable to plough the ridges at any time, and they must certainly never be ploughed till they have been in existence for at least twelve months.

Cultivation along the ridges may be carried out and does not present any great difficulty, if ridges are of the cross section advised in this article.

Napier fodder, bamboo and sunn-hemp are suitable crops for ridges. These crops bind the ridges, and if Napier fodder and bamboo are planted they will act as wind breaks. Mulberries are also useful and grow easily from cuttings.

Discharge from Ridge Terraces.—The discharge from ridge terraces may be into artificial storm drains or natural water courses, and very occasionally on to virgin veld which has a good vegetal covering.

In discharging into storm drains, the bed behind the ridge must continue on grade right into the bed of the drain, and no sudden drop down at the end of the ridge must be permitted. The construction will gradually change from a bank into a cut; that is, the top of the artificial embankment will get nearer and nearer to the natural ground level, while the bed behind will be cut gradually deeper into the earth till it runs

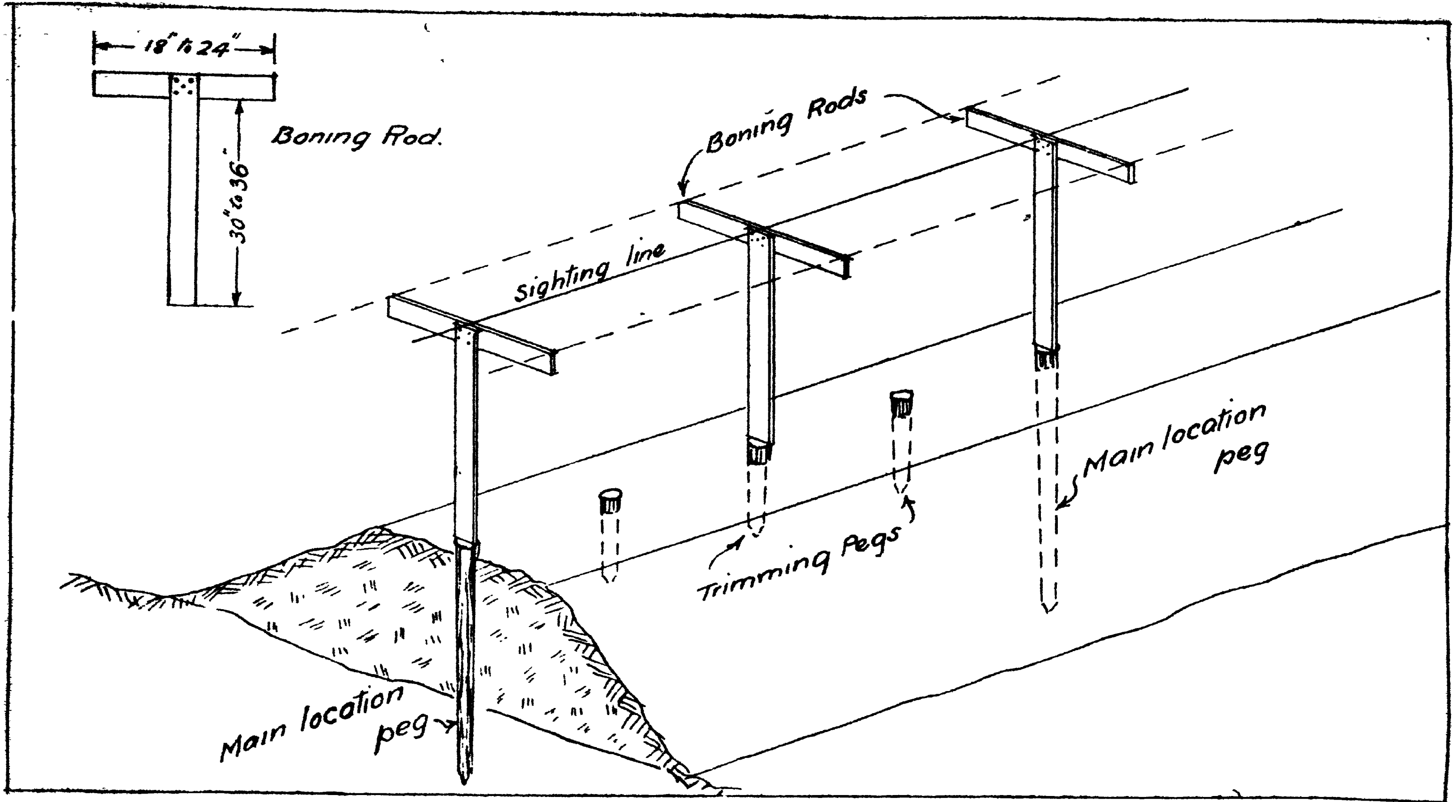
18" to 24"
30" to 36"
Boning Rod.
Boning Rods
Sighting line
Trimming Pegs
Main location peg
Main location peg

Fig. X.

Typical ridge terracing, as constructed on Mr. G. Rattray's farm Kingston, near Bindura.

into the storm drain bed at the level of the latter. This may cause a slight turn up of the ends of the ridge. The last 100 feet of the ridge may be set on a *slightly flatter* grade than the remainder.

The matter of suitable crossing points on storm drains for wagon and implements has to be considered in relation to the discharge of ridge terraces into the drains.

It is often found convenient to finish the ridge terraces before they join a storm drain and allow two or three to discharge into a small subsidiary drain some 15 to 20 feet away from and running parallel to the main storm drain. This subsidiary drain after receiving the discharge from the two or three ridge terraces is then turned to discharge into the main drain.

By adopting this method wagons and implements are required to cross fewer obstacles, and actually cross one small subsidiary drain only, instead of two or three ridges.

The crossings should be dished out and paved with hard brick or stone pitching.

Where a ridge discharges into a natural watercourse, and it is not possible to carry the bed of the ridge on grade right into the bed of the watercourse, protection against erosion of the watercourse bank must be resorted to. This can most conveniently be effected by stone pitching, either "dry" or cement grouted.

A natural watercourse must not be overloaded beyond its natural carrying capacity, by discharging ridge terraces and storm drains into it, unless precautions are adopted to prevent erosion in the bed and along the banks.

Cost of Ridge Terraces.—Ridge terracing is an inexpensive form of soil conservation work; the actual cost in practice varies slightly, according to the condition and type of soil, and the method of construction employed.

A farmer carrying out the work for the first time will generally exceed the cost of ridging as carried out by anyone with previous experience, but with more knowledge costs are rapidly reduced.

On an average ridge terracing costs between ½d. to ¾d. per lineal yard, which results in a cost of about 2/6 to 3/9

per acre protected. Costs vary also with the method adopted in carrying out the work. As an example the following are the actual costs on a farm of ridging with a *paraffin tractor and ditcher*:—

5,100 yards of Ridge Terracing.	Area protected, 100 acres.		
Paraffin fuel, 5 cases @ 16/6	£4	2	6
Lubricating oil, 2½ gallons @ 6/-	0	15	0
Tractor, etc., depreciation	4	2	6
Native driver, wages 2½ days @ 1/6... ...	0	4	0
Native labour on ditcher	0	6	0
Trimming ridges, 113⅓ native-days @ 9d.	4	5	0
Depreciation of shovels	0	10	0
Extra cost of hurdles	0	10	0
Total	£14	15	0

Cost per lineal yard = .694 pence.

Cost per acre protected = 2/11½.

Maintenance.—The maintenance of ridge terraces costs very little per annum, but is essential.

Natives will invariably be found excavating in the ridges for small field vermin, and care must be taken to prevent this as far as possible and to make good any damage before the advent of rains each year.

An annual inspection of all ridges should be made previous to the rains and all holes, subsidences and agricultural machinery tracks made good.

It is essential that one or two inspections be made during the rains and the banks carefully examined for dangerous features which may form the causes of the ridges bursting.

Gulleys and Small Washouts.—A gulley or "donga" which has not got beyond control may be prevented to a great extent from further erosion by making it "step down," that is, by forming steps in the bed, the stretches between steps being either level or on a gentle grade. This is best achieved by means of boulder-net weirs constructed across the gulley. These boulder-net bolsters are formed by enclosing well packed boulders and stone, of as large a convenient size as possible, in wire netting. Pig netting may be used, or else a network may be made of fencing wire, the strands being twisted at all intersections.

A trench is first excavated across the gulley bed to a depth of 9 inches to 1 foot. Wire netting is then laid in this trench and the stones well packed in. It is advisable to pack the stones in concave layers, so that there will be a tendency for them to pack more tightly towards the centre line, under their own weight. The layers are placed extending right across the gulley and the concavity is formed by each layer sloping down from the up-stream and down-stream edges of the trench to the centre line running across the donga. When the packing is completed, the netting is brought up each face of the bolster and laced with wire at the top. Boulder-net weirs should not be higher than 2 feet for any one season, that is, 2 feet above the natural bed of the gulley. If silting is complete after one wet season, further bolsters, to a height of another 2 feet, may be placed slightly up-stream of the original one. This will form a step with a sloping down-stream face. When placing such bolsters across the bed of a gulley it is also necessary to cut trenches down the banks from the top of the bed and place boulder-network in these, in order that the water may pass through an opening which will not erode (see Fig. IV.).

A further necessary precaution against erosion is to set stone pitching immediately below the weirs in order to prevent potholes from being scoured out by the falling water. The planting of timber along the sides of gulleys and the encouraging of the growth of vegetation on the sides and in the bottoms are also advocated. Small washouts in the land itself may be stopped in a similar way by small boulder weirs or earth banks placed at close intervals across them.

Another method of silting up these small washouts is to place a row of timber stakes across them. These must be well driven into the ground and should not project more than 9 inches to 12 inches above the ground surface. Light branches, etc., are then intertwined through the stakes and the silt is held up behind these barriers. This method is often employed where rock is unobtainable in the land itself. Great care, however, must be taken to see that the stakes are driven well down. In driving the stakes in, the tops of those in the centre should be lower than those nearer the sides. thus

forming a dished-out opening. This minimises to a great extent the "cutting round" the stakes, which often otherwise occurs.

Another temporary and effective method of silting up small washouts is to cut down branches of trees and stake them in the bottom of the washout, with the smaller branches and twigs pointing up-stream.

Erosion of the banks of gulleys, etc., may be prevented by constructing hurdles of stakes, with brushwood and grass intertwined, and staking these hurdles along the faces of the banks. For large gullies, the only method of preventing further growth and causing silting up is by the construction of concrete or masonry weirs. Special designs are necessary for these and could be prepared by the Irrigation Division. Initially, however, an inspection by an Engineer will be necessary.

Roads.—The efficient protection of farm roads is a subject which is often not considered in any way. It is of great importance and should receive the attention of all farmers. Proper drains should always be provided. If this is not done the road itself develops into a gulley and becomes useless for the purpose of transport. When this occurs, the usual practice is to make another road next to the original, and this continues *ad infinitum*. Road drains, where necessary, must be stepped down and should discharge at as many convenient points as possible. The road surface itself should be slightly cambered; this prevents water standing on the road and eventually forming a quagmire.

Cattle and other Tracks.—It is very undesirable to have any permanent cattle or similar tracks through cultivated land, as these will develop rapidly into washouts. Permanent tracks through the lands to dips or watering places are often seen on farms, and this deplorable practice should be stopped before the damage done becomes too great to remedy.

Conclusions.—The best advice that can be given to farmers is to *do a little every year and adhere to a definite programme.* It has taken many thousands of years to produce the rich soils of this Colony, and the soil filched by uncontrolled erosion can never be replaced in a man's lifetime.

Citrus Fruit Growing in Rhodesia.

By G. W. MARSHALL, Horticulturist.

(*Continued.*)

How to Apply Manures.—Manures and fertilisers may be applied by—

(a) broadcasting;
(b) placing in furrows or trenches;
(c) mulching.

With mature groves the broadcast method is almost exclusively adopted, for if the manure or fertiliser is evenly distributed over the whole grove and is well turned under, all of the spreading roots can draw upon it and so nourish the growing trees. But when manuring a young orchard it is generally best to spread the manure only over a slightly larger area than the zone actually occupied by the roots of the trees; if spread too distant from the root zone, a large amount of the manure may be lost.

Trench or Furrow Method.—It is claimed that this method has an advantage over the others, in that the manure will be placed directly in the root zone area and that it will induce deeper rooting. The latter claim is possibly correct, but on the other hand the tree's root system is encouraged over a more limited feeding area than is the case when the broadcasting method is adopted. It is true that with the broadcasting method there is some danger, especially where deep furrow irrigation is practised, of causing soluble plant foods to rise above the root system of the trees midway between the irrigation furrows. This objection may, however, be overcome by shallow furrow or basin irrigation to drive the plant foods down within reach of the roots.

If the trench method is adopted it should be commenced when the trees are still small. The first trench is then made fairly near the tree is and is about one-quarter filled with

manure and then closed. The next year the trench is made on the opposite side of the tree, but at slightly greater distance away than the first, and the manure is similarly filled in and covered. Presuming that during the first two years these trenches have been made on the north and south sides of the trees, in the third year the trench may be placed on the east side and in the fourth year on the west side. Thus every year one side of the tree is manured. The trenches each season are made at an increased distance from the tree until the centre between the tree rows has been reached, when the manuring may be continued down the centres of the rows for the rest of the applications.

Fig. 17 illustrates broadcast and trench manuring, the trenches being shown on the one side only. The numerals 1 to 4 represent the trench distances on the four sides, commencing with 1 on the north, 2 on the south, 3 on the east and 4 on the west side. Five represents the central trench between two rows of trees.

Mulching.—When citrus trees are very closely planted and the soil over the roots is of no great depth, mulching with vegetable matter and manure will often be found advantageous.

Cover Crops.—It should be the aim of every citrus grower to put in annually a leguminous summer cover crop between his trees to supply the soil with the necessary humus and nitrogen. Previous mention has been made of when to plant and plough under the cover crop, and there is no necessity to repeat this here.

Clean cultivation throughout the whole year is objectionable, and under such treatment poor results may be expected as compared with groves regularly cover-cropped.

There are many legumes which may be used for the purpose—Sunn-hemp, kaffir, velvet, dolichos and other beans, also peas, etc. Bush varieties of beans are preferable to climbers, and care must be exercised that the crop planted is not subject to the attack of insect pests, which may later turn their attention to the fruit trees.

Pruning.—While the orange tree requires less pruning when once established than most other fruit trees, it is yet necessary to attend to this constantly in the early stages of its life in the grove. Young trees growing isolated as they do, with free access to light on all sides, should shape themselves perfectly in accordance with their own demands. If the prunings of young trees is correctly performed, the work will be limited to the removal of all sprouts that appear on the tree trunk and to the cutting out of cross, broken or diseased branches. The fact must not be overlooked that the leaves are the part of the plant that manufacture the carbohydrates necessary in the growth of all parts of the tree; thus when the trees are heavily pruned a setback will occur and the normal growth will be adversely affected.

On the trees reaching bearing age, pruning should be confined to the cutting out of the dead, damaged and diseased or decadent limbs and to the removal of branches likely to touch the ground. This permits of implements working slightly under the trees. All water shoots must be cut off when they appear on the trunk or other part of the tree.

The lopping off of the bottom branches should not be excessive, as is shown by Fig. 24, the aim being merely to prevent the fruit carried on such branches from rubbing on the ground. When large limbs are to be removed, owing to disease or some other cause, the limbs should be cut off well against the remaining wood without leaving a stub. These stubs cause endless water shoot growths, or they may die back and so impair the general health of the tree. Wounds of one-half inch in diameter and over should be neatly trimmed with a sharp knife and then painted with an oil paint similar is colour to that of the bark of the tree; huge white or red blotches on the tree are unsightly and should be avoided.

The best period within which to prune orange trees is from the time harvesting is completed up to the first signs of spring growth; if this practice is followed, little or no damage will occur to the fruit crop.

The foregoing remarks regarding the pruning of orange trees apply equally to grape fruit and naartje trees; lemons may be pruned more heavily.

Spraying and Fumigating.—It should be clearly understood that spraying and fumigation are just as much an essential part of the curriculum of citrus grove work as any of the cultural operations. Some growers are under the impression that there are more pests to content with in this country than elsewhere, but this is not so, and provided reasonable attention is given, it is no more difficult to control attacks here than in other parts of the world. In all countries where fruit growing is carried on commercially, spraying or fumigation of the trees is recognised as part of the regular grove routine and is considered a form of insurance against loss. If trees are neglected through want of cleansing from either insect or fungus troubles, it cannot be expected that returns from the grove will be satisfactory.

Of recent years considerable improvements have been effected in regard to appliances and remedies necessary for spraying, and it is now possible to procure effective pumps for small or large groves, as well as the spray mixtures, with full directions on their containers for mixing, etc.

When purchasing a spray pump to be worked either by hand or power the outfit should be capable of thoroughly atomising the spray mixtures, failing which efficient results will not be obtained. High pressure pumps give the best results and should be equipped with good quality high pressure hose pipes with suitable rods and nozzles.

When once a spray pump is purchased it must be well cared for; leaky joints must be remedied, for they not only waste material, but may injure the operator. The pumps must be regularly washed out with clean water after use, and they should then be placed under suitable cover. The hose pipe should be kept in a dark place when not in use and should never be allowed to lie about in the hot sun during breaks when spraying is in progress.

Fig. 24 Orange tree without sufficient foliage protection for the main stem. Note the weak Y crotch, likely to split when the tree is in full bearing To prevent splitting, bolt the stem at point marked by arrows

The aims and objects of spraying are to destroy, prevent or control the injurious pests and diseases that may be troublesome in any given locality. If a pest is found to be increasing in the citrus grove and the natural enemies are unable to deal with it, and if it is possible to effectively destroy or control it by spraying, the spray outfit must at once be brought into action, weather permitting. The necessary spray material should always be kept in readiness, and the mixing and application should be thoroughly done under competent supervision.

Mix the spray as directed on the container, then before spraying, thoroughly agitate it by placing the nozzle in the mixture tank and pump for a few minutes; this prevents the mixtures that settle quickly from being sprayed on the trees at varying strengths.

When applying spray mixtures which destroy the insects by poisoning their food or kill them by suffocation or absorption, the trees must first be sprayed in such a way as first to cover the under side of the foliage and subsequently the upper surface of the leaves. If sufficient pressure is used and the spray rods are well handled, the tree may be completely covered with a thin film of spray material without unnecessary loss by dripping from the foliage.

Combination sprays may be used to control or destroy a pest or prevent a disease, but care must be exercised that the materials can be mixed with safety. In Mr. W. A. Larmuth's "Sprays and Spraying," issued by the Cape Explosives Works, Ltd., Somerset West, C.P., a valuable chart on the mixing of sprays is supplied. This publication, along with several bulletins on the control of insect pests, etc., published by the Department of Agriculture, Salisbury, gives all the necessary remedial measures to be adopted.

Most spray mixtures contain poison in one form of another and must be kept continually under lock and key when not in use.

Many citrus pests are effectively controlled by natural enemies in Rhodesia, and general spraying or fumigation must be avoided where possible if nature's method of pest control is to be assisted.

If the citrus trees are kept under continual observation, and if any pests increase beyond the capacity of their natural enemies to control them, the affected areas must be treated once, and if this is done most pests can easily be kept in check without completely destroying nature's assistants.

If all fallen and stung fruit is continually collected and thoroughly destroyed, it will help materially in the control of several grove troubles.

The most effective control of most citrus scale insects is secured by fumigation with hydrocyanic acid gas. Many methods of fumigation are in use, such as those known as cynofumer, cynogas, liquid cyanide, pot method, calcium cyanide and zyklon. Each of these methods has advantages or disadvantages as compared with other methods, and it would be unwise to recommend any one as the best. Five of these methods have been tested in Rhodesia during the past two years, and in each case the scale kills have been equally satisfactory when the treatment has been applied correctly.

Instructions are issued in bulletin form by the manufacturers of the various chemicals used in fumigation, and there is no necessity to deal further with this subject.

A very brief list of troublesome citrus pests, together with the remedy found satisfactory in controlling them, is tabulated below for the benefit of readers of this article.

In order to control diseases, spraying must be done before the disease is present; prevention is better than cure. Bordeaux mixture or lime sulphur may be used. These mixtures are now very easily obtained, and the spraying directions will be found on the containers.

Some Common Rhodesian Citrus Pests.

Pest.	Natural enemy.	Treatment.
Scale, red	Red knotted fungus along eastern border and parasite	Fumigation, resin wash, lime sulphur, miscible oil-glue mixture.
Scale, purple	Unknown...	Same as for red scale.
Scale, oleander ...	Parasites	Treatment seldom necessary, or as above.
Scale, black	Parasites	Not necessary if parasites present.
Scale, soft...	Parasites	Spray or fumigate if parasite fails.
Scale, mussel... ...	Unknown...	Spray or fumigate as for red scale.
Black aphis	Parasites, etc. ...	Tobacco extract, lime sulphur, resin or soap wash when infection is bad.
Orange caterpillar	Unknown...	Crush young and collect large ones weekly.
Boll worms	Wasps...	Hand collect.
False codling moth	Ants, etc.	Collect and destroy fallen fruit.
Australian bug ...	Ladybirds	Not necessary if ladybirds present.
Mealie bug	Parasites	Not necessary.
Fruit moth	Unknown...	Hand collect at night.
Fruit fly	Bats, etc.	Hang small branches dipped in poison bait in trees. Destroy stung fruit.
Thrip	Unknown...	Spray with lime-sulphur nicotine mixture.
Citrus psylla	Unknown...	Seldom necessary, or resin wash.

The harvesting, packing and marketing of citrus fruits will not be dealt with in this article. Before concluding, however, it may be as well to mention that the Rhodesian citrus growers have a real live organisation in the Rhodesian Co-operative Fruit Growers' Association, Ltd., which is out

to assist all who are desirous of selling their fruit to advantage; and if those growers who are not already members will join the association by purchasing a one pound (£1) share, the association will be fully representative of all growers. The co-operative purchase of necessary packing material is undertaken and all fruit export details arranged for the growers, such as railage, shipping, etc.

SUMMARY.

Rhodesia can produce good citrus fruits if the trees are well planted and cared for.

The "Valencia Late" orange is the best standard fruit for Rhodesian export.

Grape fruit should only be grown where it is likely to produce export quality.

Careful records should be kept to ascertain the best parent trees and also the unprofitable ones.

Bud-wood should be taken only from trees known to produce large annual crops of good quality fruit.

The common rough lemon may be used as a stock; it is so far the most suitable for Rhodesia.

Only the best grown healthy lemon stocks should be planted in the nursery, all others being discarded.

Stocks should be budded at least nine inches above the ground, using the inverted "T" bud method for budding.

All unprofitable trees should be top-worked when they are still fairly young.

A southern or eastern aspect should be chosen for the citrus grove.

If no suitable natural shelter exists, artificial shelter should be provided for the grove.

Deep, well-drained, sandy soils are best for producing quality fruit.

The lands should be well prepared and graded before planting the trees.

The grove should be laid out on the contours, using the square system of planting.

All tree holes should be dug two feet cubed.

The trees must not be planted deeper than they stood in the nursery.

Newly planted trees should be headed back in proportion to the retained root system.

Water for irrigation must be provided when it becomes necessary.

In furrow irrigation the leads must not be too long.

The trees should be supplied with liberal amounts of manure and fertilisers.

Broadcast the manure and fertiliser between the trees, then plough it under.

Leguminous cover crops should be planted at the commencement of each rainy season; then plough the crops under when the maximum growth is attained.

Citrus trees should not be pruned too heavily.

"Washington Navel" orange trees should be irrigated at frequent intervals during the setting of the fruit crop; this often prevents undue shedding of the immature fruit.

Natural enemies control or destroy many citrus pests, and growers should only treat those trees where a pest is likely to increase beyond their capacity.

The grove should be well ploughed towards the end of the rainy season, then cultivated frequently to eradicate weeds and prevent the unnecessary evaporation of soil moisture.

Join the Rhodesian Co-operative Fruit Growers' Association, Ltd.

Southern Rhodesia Veterinary Report.

MARCH, 1934.

AFRICAN COAST FEVER.

No cases to report.

TRYPANOSOMIASIS.

Twelve cases in Melsetter district and one in Hartley district.

HORSE-SICKNESS.

Several cases reported in Salisbury and Lomagundi districts.

MALLEIN TEST.

Seven horses were imported and tested with negative results.

TUBERCULIN TEST.

2 bulls, 6 heifers were tested on importation; no reaction.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Bulls 2, heifers 6, horses 7, sheep 604, pigs 21.

EXPORTATIONS.

Cattle to Durban Cold Storage for export overseas:—3,506 head.

To the United Kingdom *via* Union ports in cold storage: Beef, forequarters, 3,416; hindquarters, 3,707; veal carcases, 48; boned-quarters, 3,562; boned veal, 21 carcases; frozen beef, 3,464 lbs.; livers, 8,179 lbs.; tongues, 5,065 lbs.; hearts, 3,845 lbs.; shanks, 4,255 lbs.; tails, 2,932 lbs.; kidneys 34 lbs.

Meat products from Liebig's Factory:—Beef fat, 22,715 lbs.; tongues, 360 lbs.; meat meal, 107,800 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 17. April, 1934.

Red Locust (*Nomadacris septemfasciata*).—A few belated Red Locust hoppers were reported during the earlier part of the month, but this species is now generally in the winged stage and the anti-hopper compaign has come to an end.

Flying swarms have been prevalent all over the Colony. Many large swarms are reported to have entered the Colony from Portuguese East Africa, and this invasion showed little or no sign of abating by the end of the month.

The flying swarms have been moving about much more freely than during March. Movements in all directions have been reported and it is difficult to extract from the reports any evidence of definite migration. The impression is, however, that the general trend of movement has been in a direction with a westerly element.

Salisbury and neighbourhood have been visited by dense swarms on several occasions during the month.

Tropical Migratory Locust (*Locusta M. migratorioides*).—Some of the swarms which entered the Colony from Portuguese East Africa were found to consist of a mixture of the Red Locust and Tropical Migratory species. Individuals of the latter species examined at Salisbury were found to have eggs considerably developed, and egg laying was definitely reported in the Victoria District. The eggs were submitted to the District Controller of Locust Operations, but unfortunately were not forwarded to Salisbury. It appears quite unlikely that hoppers can mature this season from eggs laid so late on account of the falling temperature and humidity. The fate

of the deposit is, therefore, uncertain. No hoppers were recorded from any eggs which may have been laid by this species late last season. The impression is that the Tropical Migratory Locust can only rear one generation per annum in Southern Rhodesia, and that any second generation must be reared in warmer and probably more humid country outside our borders. It is possible that the swarms in general leave the Colony after the first generation has obtained wings. In any case swarms of this species have not been in evidence after March during the past two seasons.

Enemies and Disease.—No reports have been received nor observations made concerning any concentration of birds on the locust swarms.

A few instances of infestation with threadworms and Dipterous parasites have come to notice.

The locust fungus *Empusa grylli*, has been recorded and has apparently caused considerable mortality amongst individual swarms in various parts of the Colony.

Damage.—The main maize crop of the country has definitely been saved from both hoppers and fliers, and a normal crop is anticipated. Individuals have, however, suffered more or less severe loss during the outbreak. Various farmers who grow a relatively small acreage of maize for consumption on the farm, have lost a considerable portion of their crops.

Damage to late maturing native crops by winged swarms is reported to be considerable in certain districts.

Outlook.—Whilst there are certain agencies at work, particularly the locust fungus, *Empusa grylli*, which, under favourable conditions are capable of a vast amount of destruction amongst the locusts, it cannot be said that at present there is any definite indication of an early abatement of the present swarm cycle of the Red Locust. It appears probable that a large number of swarms will be prevalent in the Colony, at least until the anticipated pre-breeding southward migration in the spring.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

APRIL, 1934.

Pressure.—Mean pressure for the month was about normal for all stations.

Temperature.—Mean temperature for the month was well above normal, notably in the south-east, where the excess was as much as 4° F.

Rainfall.—The rainfall in most parts was above normal, the majority falling between the 7th and 11th.

APRIL, 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max Min.	Normal	Dry Bulb	Wet Bulb.	%	F	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	92	54	85 2	63.6	74.4	70.4	72.2	65.7	71	62	...	0 69	1.24	4	...
Beit Bridge	966.3	...	98	55	88.8	65 0	76.9	...	75 4	67.3	66	63	3.5	...	.37	...	1,510
Bindura...	893.3	...	87	48	81 9	59 6	70.7	...	68.4	62.4	71	59	3.6	1.51	1.70	5	3,698
Bulawayo	870.7	870.6	87	49	79.6	56.8	68.2	65.9	68.1	59.9	63	55	4 2	0.16	.67	3	4,425
Chipinga	894.5	...	84	55	75.7	59 9	67.8	...	68.2	62 7	75	59	4.2	2 78	2.61	10	3,684
Enkeldoorn	859.5	...	84	48	77.9	55 7	66.5	64.6	65.7	59.8	72	55	4 2	0.32	.68	4	4,787
Fort Victoria	897.5	897.6	90	46	80.8	57 4	69.1	65 0	68 6	62.1	71	58	3 7	0.13	.61	1	3,570
Gwaai Siding	906.0	...	92	41	86.1	56.6	71.3	...	70.0	62 2	64	57	2.2	2.35	1.42	7	3,277
Gwanda	908.1	...	91	49	82.9	58.6	70.7	...	69.9	62.9	69	59	2.7	0.38	.51	3	3,228
Gwelo	...	...	86	41	78.2	55 7	66.9	65.5	65.9	60.0	72	56	4.2	1.80	.71	5	4,627
Hartley	888.2	...	87	45	82.5	56.4	69.4	...	66.7	61.2	73	57	2.7	1.40	.72	7	3,878
Inyanga	838.2	...	77	46	72.2	54.8	63 5	...	65.0	57.9	65	53	1.7	2.08	1.03	7	5,513
Marandellas	...	...	...	..	...	...	...	...	...	...	..	...	...	2 79	1.26	7	5,450
Miami	880.3	...	84	50	79.2	58.1	68 6	..	68.1	62.6	74	59	3.0	3.79	1.29	7	4,077
Mount Darwin ...	909 0	...	89	47	83 6	59.9	71.7	..	71 3	64.7	70	61	4 0	0.21	.47	3	3,178
Mount Nuza	803.4	...	72	45	62.3	50 5	56.4	...	55 7	53.2	86	51	6.7	7.85	...	13	6,667
Mtoko	878.9	...	87	51	81 6	59 5	70.5	...	69.6	62.6	68	58	2.2	0.15	.55	1	4,140
New Year's Gift...	...	...	90	50	82.5	60.3	71 4	67.8	68.7	63.6	76	61	...	1.20	.72	8	2,690
Nuanetsi	964.1	...	98	49	87.4	61 9	74 6	...	73.5	67.4	73	64	4.4	1.16	.67	2	1,650
Plumtree	866.2	...	86	50	79.6	58 2	68.9	...	69.1	59.5	57	53	2 1	1.51	...	3	4,549
Que Que	884.0	...	87	49	81 3	57 1	69.2	...	68 2	61.3	68	57	3.5	1.83	.72	6	3,998
Riverbank...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4,090
Rusape...	864.0	...	82	43	76.9	54.0	65.5	...	63.9	59.2	76	56	3.8	1.91	1.20	7	4,646
Salisbury	856.5	856.3	83	43	78.5	55.2	66.9	65.5	66.6	59.8	68	56	3.0	1.76	.99	6	4,885
Shabani	909.7	...	93	54	83.0	61.7	72.3	...	69 3	62.9	71	59	4.9	0.77	.56	3	3,192
Sinoia	889.6	...	88	42	83.4	55.8	69.6	...	69.7	62 4	67	58	2.3	1.38	1.00	6	3,793
Sipililo	886.8	...	85	49	80.6	59.2	69.9	...	70.2	62.7	66	58	2.0	0 84	1.30	4	3,875
Umtali...	895.2	894.9	86	49	78.6	59.6	69.1	66.2	67.5	63.4	80	61	5.1	3.39	.99	8	3,670
Wankie	928.6	...	95	59	88.6	65.5	77.1	...	73.3	63.4	58	57	2.0	1.80	.48	6	2,566

Farming Calendar.

JUNE.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perenials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding

ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire-guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold mornings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

JULY.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry our repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay

and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inches over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
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No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.
No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwtring, Agriculturist.
6o. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762.—The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

No. 823. The Law of Supply and Demand—No. 2, by J. R McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

No. 838. Witch Weed—Progress Report and a Warning, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist. and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.

No. 867. Agricultural Statistics for the Season 1930-31: (a) Live Stock; (b) Crops Grown by Europeans in Southern Rhodesia, compiled by the Government Statistician.

No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

No. 901. Some Notes from the Cotton Station, Gatooma, by J. E. Peat, B.Sc. (Edin.), A.I.C.T.A. (Trinidad).

REPORTS ON CROP EXPERIMENTS.

No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

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THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Export of Cattle to the Johannesburg Market.—The regulations governing the export of cattle to the Johannesburg market were published in the *Government Gazette* and in the daily press at the beginning of June. The number of animals allowed at present cannot exceed two hundred head per week, and these must weigh not less than 1,050 lbs. for oxen and 790 lbs. for cows at the time of despatch from one of the recognised ports of exit. At present the recognised ports of exit, at which weighing facilities exist, are Salisbury, Bulawayo, Fort Victoria, Gwelo, Marula and Beit Bridge. It should be noted that permits for export will not be granted by the District Veterinary Surgeons who inspect the animals

unless the animals are up to weight and are free from ticks. All persons who wish to export must apply in the first place to the Secretary, Department of Agriculture and Lands, Salisbury, and applications should be sent on or about the 25th of the month for export permits for the following month.

Permits are not transferable, but applications for permits may be made by agents, provided that the necessary form of application, signed by the owner in each case, is submitted by the agent in support of his application. Permits will normally be issued for truck loads of 11 bullocks or 12 cows. For the present, cattle will be despatched from Bulawayo on Sundays and from Beit Bridge on Mondays. Exporters should ascertain from the local representative of the Railway Company when cattle should be trucked at intermediate points to connect with these trains. Applicants must make their own arrangements for trucks after receiving their allocation, and should carefully verify the time and date of despatch.

Resignation of Dr. D. G. Haylett.—It is with regret we announce that the Director of Rhodes Matopo Estate and School of Agriculture, Dr. D. G. Haylett, has resigned and leaves at the beginning of this month to take up his new duties as research plant physiologist to the Cape Orchards Company. With his long university training and experience in South Africa he is particularly well qualified to undertake investigations of this nature, and we wish him all success and happiness in his new work.

From the Department's point of view Dr. Haylett will be sadly missed, as the work he has carried out at Matopos has been greatly appreciated. During the four years he has been in charge he has re-organised the institution and laid the foundation of a promising series of experiments of the greatest fundamental importance, which will, if continued, be of the greatest benefit to the country.

Drying Maize.—In this issue appears a short article on the drying of maize in tobacco barns by a method which is different from that contained in the Departmental bulletin printed a few months ago. For this we are indebted to Mr. H. P. D. Dimmock, of Erdington Farm, Fort Victoria. The method devised by Mr. E. G. Birch and Mr. Dimmock is obviously a very satisfactory one and has several advantages not shared by methods previously suggested. The maize is reaped in the usual way and stacked on a wire netting platform raised some five feet above the floor of the barn. The whole surface must be covered right up to the walls on all sides so that the hot air cannot rise except between the cobs. The platform, or platforms if two tiers are used, are supported from the ground so that the weight is not taken by the walls. Mr. Dimmock's action in bringing this method to the notice of the Department is greatly appreciated and we are sure all readers will be interested both in the method adopted and in the results achieved.

Rebate on Railage of Store Cattle.—The Rhodesian railways have for the last three years granted a rebate of 50% of the forward railway charges on cattle brought from Matabeleland to Mashonaland for the purpose of feeding for export. In order to claim the rebate a certificate of inspection had to be supplied and, in order to keep check of the animals, they had to be identified by a special metal ear tag.

This concession was greatly appreciated, and we are glad to be able to state that, on the recommendation of the Department of Agriculture the General Manager has now agreed to extend this concession to all cattle railed for feeding purposes for export between any points either in Matabeleland or Mashonaland. This, it is believed, will react very beneficially on the export trade in cattle and will enable stores to be drawn from Fort Victoria and other areas which could not be considered previously because of the narrow margin of profit under present conditions.

Soil Conservation Advisory Boards.—It will be remembered that the Rhodesia Agricultural Union Committee on Soil Erosion reported to the Government about a year ago, and the report was also presented at the last R.A.U. Congress. A number of the recommendations have been acted upon and steps have been taken to supply information which will be essential to guide future action. A soil erosion experiment has been laid down on Glenara and a Conference discussed a further programme in April this year. To ensure that constant attention is given to this most important question the R.A.U. Committee recommended that Advisory Councils should be created, one for Matabeleland and one for Mashonaland. The Government has now approved of the appointment of the two Boards referred to. The Matabeleland Board will consist of the Superintendent of Natives, the Government Mining Engineer, the Divisional Road Engineer, the Railway Engineer, and the Irrigation Engineer (Chairman).

The constitution of the Mashonaland Board will be three representatives of the Rhodesia Agricultural Union, together with the Assistant Chief Native Commissioner, the Government Mining Engineer, the Chief Road Engineer, the Railway Engineer, Salisbury, the Manager of the Land and Agricultural Bank, the Chief Irrigation Engineer, and the Secretary, Department of Agriculture and Lands as Chairman and Convener.

The Maize Control Amendment Act

No. 17 OF 1934.

By E. R. Jacklin, Chairman, Maize Control Board.

The Maize Control Act of 1931 instituted compulsory control of all maize produced in certain parts of the Colony, but left a free market in the remaining areas. This Act was drastically amended by Act 24 of 1933, which, however, continued the exemptions previously applied. The new Act of 1934 extends the control over the whole of the Colony and continues its operation until the 31st May, 1936. It also introduces a two pool system under which small growers are to participate in respect of a larger proportion of their deliveries to the Board in the proceeds of sales in the local market than the large grower. The two pools are to be called respectively the Local Sales Pool and the Export Pool.

The basis on which quotas in the Local Sales Pool will be allocated is prescribed in two schedules to the Act, the first of which applies to European growers who surrender 300 bags or less during the pool year, and the second to European growers who deliver larger quantities. Growers to whom the first schedule applies are to be given a quota representing a specified percentage of the quantity they deliver during the year. On the other hand those falling under the second schedule will have their percentage based on their "average of sales," that is, on the average quantity they alienated annually during a period of two years determined by the Minister. It follows that a grower who is entitled on the basis of his "average of sales" to a quota of, say, 600 bags and who delivers this quantity only will have the whole of his

deliveries in the Local Sales Pool. If he delivers more than 600 bags he will share in respect of the excess in the Export Pool.

For the pool year 1934/35 the "average of sales" will be based on the average quantity alienated annually during the two years ended 31st May, 1933.

The average of sales will, in the instance of growers in the districts which have been under control for the past three years, be ascertained from the Board's accounts, and in the instance of producers in the districts which were previously exempted, from the returns which they submitted to the Board in terms of the Act of 1931. Any producer who considers that this basis would not in his case be correct should notify the Board and have his claim examined.

Provision is also made in the Act for the case of the grower who did not sell or otherwise alienate maize during either or both of the two years on which the average of sales is calculated or who can show that a quota based on his average of sales would result in hardship or inequity. Such a grower may, on his furnishing such information as the Board may require, be given such quota as the Minister approves.

The first and second schedules of the Act are given below:

First Schedule.

No. of Group.	Quantity surrendered expressed in in bags.	Quota percentum of maize surrendered.	Notwithstanding the quota percentum of maize surrendered as set out in this schedule, there shall be a minimum and maximum number of bags in quota for each group as set out hereunder. Minimum.	Maximum.
1.	1-100	80	—	78
2.	101-200	75	78	145
3.	201-300	70	145	210

Second Schedule.

No. of Group.	Biennial average of sales expressed in bags.	Quota percentum of biennial average.	Notwithstanding the quota percentum of biennial average as set out in this schedule, there shall be a minimum and maximum number of bags in quota for each group as set out hereunder. Minimum.	Maximum.
1.	301-500	70	210	338
2.	501-750	65	338	478
3.	751-1,000	62½	478	613
4.	1,001-1,250	60	613	719
5.	1,251-1,500	55	719	788
6.	1,501-1,750	50	788	832
7.	1,751-2,000	45	832	850
8.	2,001-3,000	40	850	1,125
9.	3,001-4,000	35	1,125	1,300
10.	4,001-6,000	30	1,300	1,500
11.	Over 6,000	25	1,500	—

The columns headed "minimum" and "maximum" require some explanation. The object of these minima and maxima is to secure an equitable graduation of the steps by which the quantity of the quotas of the successive groups is increased. An example will make the matter clear.

Group 9, 3,001 to 4,000 bags, is given a quota of 35% and Group 10, 4,001 to 6,000 bags, a quota of 30%. If these quota were not modified as provided for in the minima and maxima columns, 4,000 bags would earn a quota representing 35% of 4,000, *i.e.*, 1,400 bags, while 4,001 bags would get 30%, that is, only 1,200 bags. It is clearly inequitable that a difference of one in the "average of sales" should make a difference of 200 bags in the quantity of the quota, and in order to avoid this difference or overlap the maximum quota of the preceding group has been reduced by half the overlap, that is, 100 bags, and the minimum quota of the succeeding group has been increased by a like amount. This principle is followed throughout the schedules. Its effect is that the maximum quota of one group is exactly the minimum of the succeeding one.

Some growers appear to be under the impression that the lower their average of sales is the larger will be the quantity of their quota. This is, of course, wrong. The small grower is given a quota representing a higher percentage of his crop than the larger grower, but it is a percentage of a smaller quantity. An average of sales of 500 bags would earn a quota of 70%, while an average of sales of 750 bags would earn a quota of only 65%; but 65% of 750 is, of course, more than 70% of 500. It follows that the man with the larger average of sales gets the larger quantity into the Local Sales Pool.

The Position of Native Producers.—Under the earlier Acts native growers had privileges which were not accorded to Europeans. The latter were required to surrender what maize they had to the Board, but the native had the option of doing this or of selling to a trader-producer or to another native. The new Act maintains this position, but provides that if the native grower wishes to participate in the results of the Board's local sales, he must surrender his maize direct to the Board precisely like the European. If he does this, he becomes entitled to a quota, but because natives are all small growers they would, under the sliding scale system, be entitled to the maximum quota in the local market which is accorded to small European growers; and in view of the large total production of natives, their system of land tenure and their methods of marketing, such an arrangement would render a quota scheme unworkable. Parliament therefore decided in equity to natives and Europeans alike, to give the native growers in the mass who surrender their maize direct to the Board exactly the same proportion of interest in the local market as is given the whole mass of European growers.

The precise arrangement is as follows: for the first year of the new system the whole bulk of native maize delivered by natives direct to the Board (not including maize sold to the Board) will participate in the Local Sales Pool in the same proportion as the whole quantity sold by the Board into local consumption during the first two years of control bore to the total quantity of maize surrendered to the Board during those years.

This gives such natives a quota of slightly more than 20%.

For every subsequent year the quota of the native producer will bear the same proportion to the total quantity he surrenders as the quantity of European maize in the Local Sales Pool in the preceding year bore to the total quantity of European maize received by the Board in that year.

This somewhat involved provision means that the native will have a quota equalling the average of the quotas obtained by the European growers in the previous year.

The Position of Trader-Producers.—The Acts of 1931 and 1933 forbade under penalty the acquisition of maize from natives, whether by purchase, barter or any other means whatever, by persons who are not registered with the Board as trader-producers, and they provided further that all maize which registered trader-producers acquire from natives shall be surrendered to the Board. These provisions remain in force, but the new Act provides further that the maize surrendered by trader-producers shall participate in the Export Pool only. For the future therefore a person who buys native maize at a price in excess of his return from the Export Pool, less his costs, will make a loss.

Registered trader-producers who wish to retain the maize they acquire from natives for re-sale or for use in mining or other than farming operations, can acquire the right to do so by purchase of such surrenderable maize from the Board. The Board will be prepared to sell them the maize as it lies on their premises and thereby free it from further control. The terms of such sales must be individually arranged, that is to say, each trader-producer must have a definite contract with the Board. Generally speaking, however, they will be on what has become known as the "cross entry plus payment basis." The trader-producer will be asked to make a cash payment to the Board and to allow the Board to set-off the balance of the price he is due to pay against the sum which the Board would ultimately have to pay him in his capacity as a participant in the Export Pool in respect of the maize in question. His claim against the Pool will be "wiped out." This is what is called "cross entry." It arises from the fact that the person who surrenders maize to the Board becomes a participant in one or other of the Pools and as such shares in the proceeds of his pool. When he purchases maize which he is due in

terms of the Act to surrender to the Board, an entry is made in the Board's books showing that he has technically surrendered the maize and is therefore entitled to a share of the Board's proceeds; and in such circumstances the distribution to which he will be entitled is applied in part payment of the purchase price.

The balance of the purchase price will ordinarily be paid in cash, although the Board is always prepared to extend credit to a buyer subject to the provision of a satisfactory guarantee and to payment of interest at current Bank rates. In assessing the amount of this cash payment the Board is guided by two considerations: (*a*) an estimate of the amount of the distribution which the grower or trader-producer could expect from the Board's Pools; and (*b*) the price at which he would be enabled to sell the maize in question in the Board's markets in competition with the Board and with dealers who have bought from the Board at standard prices.

As regards (*a*) it can fairly be assumed that since the trader-producer cannot expect to receive a distribution from the Export Pool of much more than 4s. in respect of the native maize he surrenders, the price at which he trades native maize will be such as will ensure that his cost of bagged maize on rail is not more than 4s. a bag. As regards (*b*) the Board has advertised that its standard price for ordinary native maize (Class D) in Mashonaland is 10s. 6d. a bag, in the Gwelo area 10s. 9d., in Fort Victoria 11s. and in Western Matabeleland 11s. 3d. It follows that the trader-producer who re-sells would have little difficulty in realising these prices. The amount of his cash payment to the Board shou.. therefore be the standard price at the place in which he re-sells less his cost on rail, 4s., and the railage to his market.

If the cash payment were only 3s. 6d., as in the past when the law permitted traders to share in the results of the Board's local sales, the trader's cost would be 4s. plus 3s. 6d. plus railage to the centre in which he sells, and on this basis he would obviously be able to re-sell at a price undercutting the Board as well as the dealers who buy from the Board at standard prices. In the new circumstances, therefore, the payment required is ordinarily 6s. or, in circumstances

referred to below 5s. A purchase cost not exceeding 4s. and a payment to the Board of 6s. gives the trader a total cost of 10s. If, however, he has transportation expenses to market amounting to more than the difference between 10s. and the standard price in that market, the Board asks 5s. or even less; but if he has no transport expenses, the 6s. is not increased, so that the trader who has a market in his immediate neighbourhood at standard prices secures an extra profit.

It will be seen that this system enables the traders to retain maize to supply the demand in their own areas at a profit to themselves. It cannot, however, be too strongly emphasised that such arrangements apply only when the trader-purchaser enters into a definite contract with the Board.

Stocks in Previously Exempted Districts.—As a result of the cancellation of the exemption which previously applied to certain districts, all maize acquired from natives in those districts is surrenderable to the Board, notwithstanding that it was traded or acquired before the new Act came into force. This obligation to deliver to the Board also applies to European growers in respect of maize they reaped before the Act came into operation and which is surplus to their requirements for their own farm use.

It should be noted that the provisions of the Act relating to maize "purchased or otherwise acquired" from natives apply to maize received in payment of rent. Such maize is surrenderable to the Board.

Maize for Farmer-Consumers.—In the past farmer-consumers who registered as trader-producers and thereby acquired the legal right to buy or trade maize from natives were allowed, subject to certain certificates being furnished, to retain the quantity so acquired on pure cross entry terms, that is without any payment to the Board. As advertised in the press, this practice has now been stopped. It was found that competition between farmer-consumers for native maize caused them to pay high prices. The farmer-consumer, whose alternative was to buy from the Board's depot stocks at standard prices ranging from 10s. 6d. to 11s. 3d. according to the centres, found it preferable to pay the native as much as 8s. or 9s. and thus created the anomaly that natives realised more than the European growers received from the pool. A further result was that the farmer-consumers' maize was

costing them more than it should do, while the European growers represented that the native maize was making no contribution to the burden of export.

A new system is now in operation which will meet these apparently conflicting interests. For the future the farmer-consumer who in the capacity of a trader-producer buys or trades maize from natives for his own farm use will be dealt with on exactly the same terms as the trader-producer who buys for re-sale. As explained in an earlier paragraph this will require him to make a cash payment to the Board of 5s. or 6s. a bag, depending on his geographical position. In other words, the trader-producer as such will be given no concession in respect of maize for farm use. The Board recognises however, that farmer-consumers who have been accustomed to trade their requirements are entitled to cheap maize. It has therefore arranged that such farmer-consumers will, on their notifying the Board of the quantity they require for own farm use and subject to their signing a certain undertaking, be authorised to trade that quantity as agents of the Board. They will buy for the Board and not in the capacity of trader-producers. These agents will be authorised to pay 5s. a bag, no more, and will be required to report the quantity purchased each month. The quantity so purchased for and on behalf of the Board will then be sold to the agent for his own farm use at 6s. a bag or 6s. 6d., depending on the locality. The 5s. a bag he paid to the native will be deducted from this price, so that he will be required to remit only 1s. or 1s. 6d. to the Board. Since his authority as agent of the Board will not permit him to pay the native more than 5s. a bag and he will pay the Board at most 1s. 6d., his maize requirements cannot cost him more than 6s. 6d. a bag, which has been stated by representative farmer-consumers to be a satisfactorily low price. The arrangement should be equally satisfactory to the European maize grower, since it secures a contribution to the burden of export from this native maize of 1s. or 1s. 6d.

The native will naturally have the option of delivering to the Board and taking a participation certificate precisely as the European does. On this basis he will share in the Local Sales Pool to the extent of approximately 20% of his deliveries, but he will have to wait for his payment from the Pools as the European does.

Purchase of Native Maize by the Board.—The new Act authorises the Board to purchase native maize, and its depot officials and agents at the various receiving stations have accordingly been asked to purchase maize at their stations at 4s. 3d. a bag for Classes A and B maize and 4s. for Class D. Class D represents the ordinary quality of traded maize.

Duties of Producers, Trader-producers and Dealers.—A leaflet is being distributed by the Board which details the duties of producers, trader-producers and dealers under the amended legislation.

Maize Requirements for Farmer-Consumers.—In view of representations made to the Government arrangements have been concluded with the Maize Control Board by which farmer-consumers who wish to trade maize from native growers for their own farm use will be enabled to do so.

The arrangement will necessitate the farmer-consumer being prepared to trade or purchase maize from natives as agent of the Board and the maize so purchased will be the property of the Board. The agent will report to the Board the quantity purchased each month and the Board will then re-sell it to him at a price which will be not more than 1s. or 1s. 6d. per bag, depending on the district, in excess of the price paid to the native.

The arrangement will be conditional on the farmer-consumer entering into a definite contract with the Board which will provide:—

1. That the price he pays to the native shall not exceed 5s. per bag.
2. That the quantity which he purchases will not exceed the quantity specified in the contract, and
3. That he will purchase from the Board at the price applicable in his district the quantity he trades as the Board's agent.

Full particulars as to the procedure to be adopted are obtainable from the Maize Control Board.

Farmers who, in the capacity of trader-producers, under the Act, trade maize from natives will not be eligible to benefit by these concessions.

This cancels any previous arrangements in regard to purchase of maize by farmer-consumers.

Gum Poles For Sale.

AT MTAO FOREST RESERVE.

A limited quantity of gum poles is for sale at Mtao Forest Reserve.

A small quantity is already cut and a further quantity will be cut as orders are received. Owing to the fact that the poles to be cut are thinnings only, the sizes are small. They would be suitable for scaffolding, building, telephone and wireless poles and small mining timber.

Prices are quoted below for the principal sizes, but a small quantity of larger sizes will be available, prices of which may be had on application.

Prices of Timber: Mtao Forest Reserve.

Mid Diameter Overbark.

Length.	1-2in.	2-3in.	3-4in.	4-5in.	5-6in.	6-7in.
6 feet	1d.	2d.	4d.	6d.	9d.	1/-
8 feet	1½d.	3d.	5d.	8d.	1/-	1/4
10 feet	2d.	4d.	6d.	10d.	1/3	1/8
12 feet	...	5d.	7d.	1/-	1/6	2/-
14 feet	...	6d.	8d.	1/2	1/9	2/4
16 feet	...	7d.	10d.	1/4	2/-	2/8
18 feet	...	8d.	1/-	1/6	2/3	3/-
20 feet	...	9d.	1/2	1/8	2/6	...
22 feet	...	...	1/4	1/10	2/9	...
24 feet	...	...	1/6	2/-	3/-	...
26 feet	...	...	1/8	2/2	3/3	...
28 feet	...	...	1/10	2/4	3/6	...
30 feet	...	...	2/-	2/6	3/9	...

TERMS.—C.W.O. Prices are F.O.R. Fairfield Siding. Deduct 5% for delivery at plantation. Orders will be dealt with in strict rotation. Apply to the District Forest Officer, Mtao Forest Reserve, P.B. Umvuma.

Notes on Artificial Drying of Maize.

By H. P. D. Dimmock, Erdington Farm, Fort Victoria.

While it is unlikely that such an opportunity as the bonus offered for early maize will occur again for many years, if ever, some notes on artificial drying of maize as carried out by Mr. E. G. Birch, of Maybrook Farm, Fort Victoria, may be of use to those farmers who possess tobacco barns and find themselves short of maize for farm use just before the normal time for harvesting.

In the first place an attempt was made to dry out maize by one of the methods advocated in Government Bulletin, *i.e.*, by tying the cobs in pairs by their husks and hanging them on tobacco sticks. This method is very slow and necessitates the employment of a big gang of boys. The maize dries out very well, but the amount of shelled grain yielded by one full barn is disappointing for so much labour, the highest being 34 bags.

This method was discarded entirely and a platform of veld timber was constructed at the height of the bottom tier of the barns. The timber was spaced about 18 inches apart and supported by bearers, also of veld timber, which in turn rested on heavy props embedded in the floor of the barn, care being taken to place these props as far from the flues as possible, and where this was not possible to coat them well with a mixture of mud and asbestos. Tobacco sticks were then lashed in lines across the platform and the whole covered with 1½ inch mesh wire netting. A gap was left near the door so that a sack could be passed up to the platform. The construction of this platform took three boys two days to complete.

Maize was reaped in the ordinary way and ridden to the barns in sacks and emptied on to the platform, 140 full bags of cobs going into one barn.

When the barn was full four boys remained on the platform and closed the gap near the door with poles and wire netting, after which they shovelled cobs over the gap until it was completely closed up and the maize lay more-or-less level over the whole of the platform. They then climbed out through the ventilator in the roof and down through an empty barn. (If an outside ladder is available they can descend that way. It would, in fact, be necessary if all the barns were in use.)

The fires were then lit and the temperatures run to 180° F. for two nights and a day, when the maize was dry enough to shell, and one barn full yielded over 60 bags of grain.

It is most important to close the gap near the door and to see that plenty of cobs are shovelled over it. Experiments were tried without closing the gap, and it was found that most of the hot air passed through the gap without drying the maize, whereas when the gap was closed there was no egress for the hot air except through the maize piled on the platform.

Later the further experiment was tried of building another platform, some six feet above the one primarily constructed, in order to double the capacity of one barn. This platform was constructed in exactly the same way and also supported by props so as to throw all the weight on the ground and not on the building. The only difference being that the upper platform was so constructed that the gap appeared in one corner of the barn and not immediately over the gap in the lower platform. The gap was closed in the same way.

The experiment was entirely successful and it is therefore possible with four barns to dry out from 450 to 480 bags of grain at one firing.

To enumerate the advantages of this method:—

1. No strain is imposed on the building as all weight is supported by the floor through props.

2. There is no danger of maize cascading and falling on the hot flues causing a fire, as may happen if cobs are placed on tobacco sticks.

3. As much as 60 bags of shelled grain (or 120 bags if two platforms are used) can be dried in one barn at a filling.

4. Reaping is carried out in the ordinary way.

5. Very little more handling is required than when maize is reaped and deposited in a crib, since wagons can drive up close to the door of the barn to unload.

6. Emptying the barn for shelling is simpler than when maize is on tobacco sticks which may slip and start a miniature avalanche.

Mr. Birch was kind enough to give me the use of two of his four barns and we commenced operations on April 15th, but it was a week or more before Mr. Birch had thought out his method and built the first platform.

Nevertheless we were able to deliver to the Maize Pool 900 bags of grain before the 20th May in addition to a further 100 bags for our own use (1,000 bags in all).

Of this amount I contributed 300 bags only, since I am not a big grower, but I see no reason why a big grower, provided he possessed tobacco barns, should not have been able to dry and sell 1,500 or even more bags by this method between April 15th and May 20th.

Dairy Buildings in Southern Rhodesia

COW BYRE—TYPE II.

By B. G. Gundry, A.I.Mech.E.

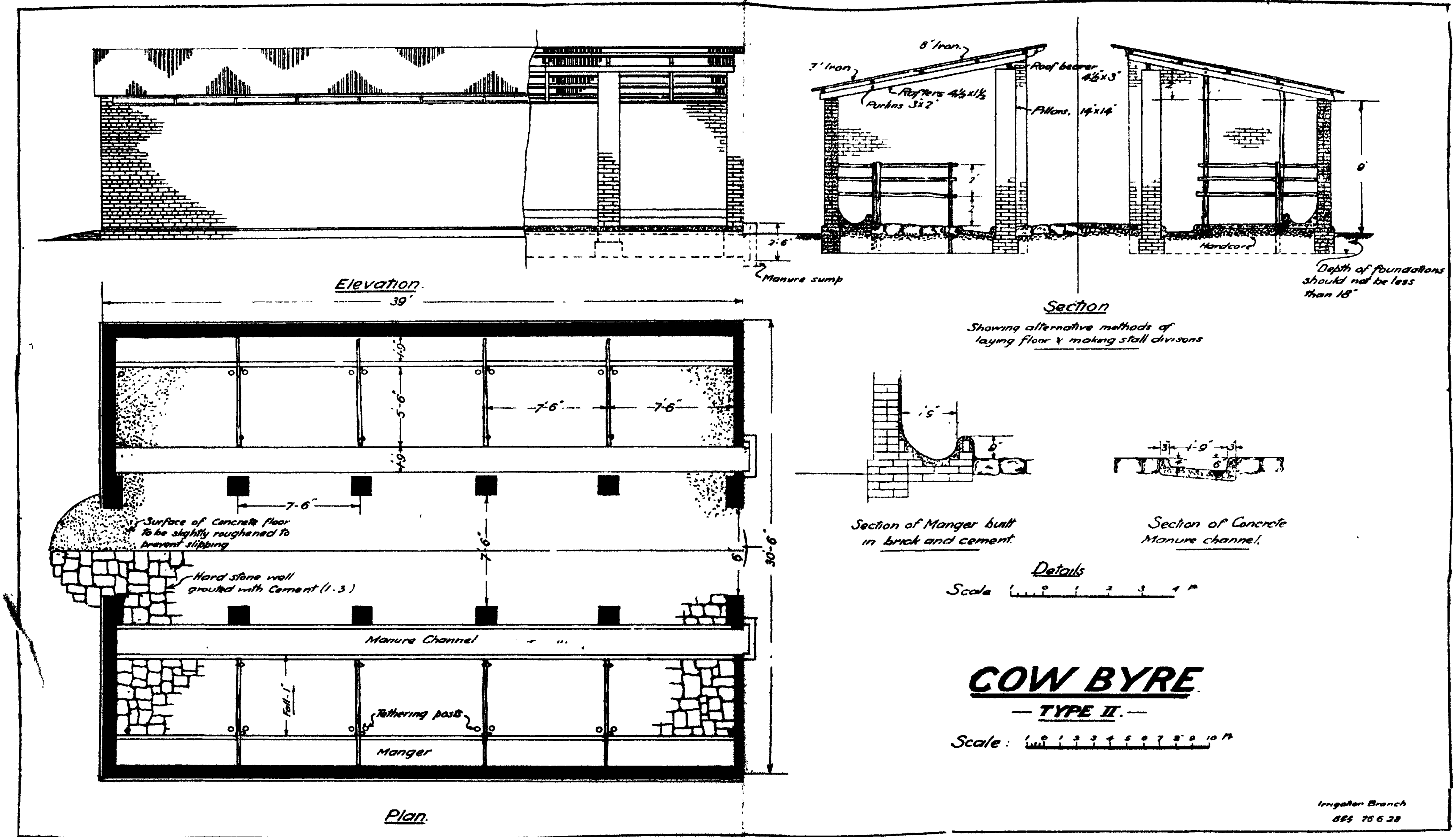
It is not proposed to discuss in this short article the relative advantages and disadvantages of the various types of cow byres which may be built, varying from a mere thatched shelter to an elaborate and costly building fitted out practically regardless of expense, but to give in some detail the description of a design which, while embodying all the more important features necessary to the health and cleanliness of the animals, can be built for a reasonable expenditure and be maintained at little cost.

The type of byre shown in the accompanying drawing has proved to be well suited to this country, and is recommended by the Government Dairy Expert and Stock Adviser as being equally suitable for a farmer keeping a few cows for his own use, and a dairyman with a large number of animals.

The cheapest type of construction will necessarily vary according to the locality and the material at hand, and certain alternative methods of construction are shown on the drawing and will be referred to hereunder.

The aspect of the building will probably depend, to a certain extent, on the site available and the disposition of other existing buildings, but, if possible, it should run north and south, and if it is desired to erect only one half of the building it should open to the west and be sheltered from cold winds as much as possible by trees or other buildings.

Foundation and Walls.—Unless good building stone is available, these should be built in brickwork, the best and hardest bricks being selected for the foundations. These



COW BYRE
— TYPE II. —
Scale: 1 0 1 2 3 4 5 6 7 8 9 10 ft
Elevation.
39'
Section
Showing alternative methods of laying floor & making stall divisons
8' Iron.
7' Iron
Roof bearer 4½x3"
Rafters 4½x1½
Purlins 3x2"
Pillars, 14x14"
Hardcore
Depth of foundations should not be less than 18"
Manure sump
2'-6"
9'
Section of Manger built in brick and cement.
Section of Concrete Manure channel.
Details
Scale 1 0 1 2 3 4 ft
Plan.
30'-6"
7'-6"
5'-6"
Surface of Concrete floor to be slightly roughened to prevent slipping
Hard stone wall grouted with Cement (1.3)
Manure Channel
Tethering posts
Manger
Fall-1"
Irrigation Branch
BBS 7 6 6 28

should be in 14 inch work and carried down until a good firm footing is reached. In most parts of the country a depth of from 18 inches to 2 feet is sufficient, but if there is any doubt about the solidity of the ground at this depth, they should be carried down further, or if this is found by trial to be useless, two or three courses of 18 inch brickwork should be laid at the bottom of the trench to give the walls a bigger bearing surface.

In naturally damp soils it is advisable to lay the foundation in cement mortar (1 part cement to 4 parts sands), but otherwise lime mortar in the proportions of 1 lime to 3 or 4 of sand may be used, but under no circumstances is the use of dagga recommended.

If good building stone is easily obtainable, no better material can be used; the stones must be laid on their natural "bed" or with their laminations horizontal, and any that show signs of cracks must be discarded.

The remarks regarding mortar for brick foundations apply equally to masonry.

The foundations should be carried up to a height of at least 9 inches above the ground level and finished off perfectly level.

A damp course consisting of bituminous felt or 26 G. galvanised iron is laid on the foundations. If iron is used, the strips must overlap each other by about 6 inches and be soldered together.

The foundations having been completed, the walls may be proceeded with. These are in 9 inch brickwork, with the exception of the end wings, which should be finished with 14 inch buttresses, to give them additional stiffness and provide a better support for the plate carrying the upper end of the roof.

The walls should preferably be laid in lime mortar, a mixture of 1 part lime to 4 or 5 parts sand being used. If good dagga is obtainable, it may be made use of, in which case the outer surfaces should be pointed and plastered with lime mortar to which a small amount of cement has been

added. A mixture of 1 part lime, ½ part cement, to 5 parts of sand should be found satisfactory, but if this plaster shows any signs of cracking on drying out, more sand must be added.

Even where lime mortar has been used for laying the bricks, the plastering of the exposed walls is advocated, as it preserves the brickwork and enhances the appearance of the building.

The inside of the walls should be plastered up to a height of 4 feet with a cement plaster of the following composition: 1 part cement, ½ part lime and 4 parts sand. This mixture is practically impervious to moisture, and can be washed down frequently without damage.

The upper portion of the walls should be plastered with the same mixture as given for the external plastering, but here the cement may be omitted.

The pillars supporting the roof are 14 inches square, resting on foundations 18 inches square, and should be built and plastered as prescribed for the walls.

If the walls are built in masonry they should be approximately 30 per cent. thicker than in brick; the external and internal plastering may be dispensed with, but in this event the joints should be carefully raked out to a depth of about 1 inch and pointed with 1 : 4 cement plaster; this is particularly important on the inside.

Floor, Manure Channels and Manger.—In this Colony one's choice of a suitable flooring is somewhat limited. Ordinary bricks are too soft and absorbent; good, hard blue bricks well grouted in with cement mortar make a fair job, but they have a tendency to wear unevenly and thus develop depressions in which moisture can collect— a very undesirable fault.

Good, hard building stone, if carefully dressed, evenly laid, and well grouted with a cement mixture of 1 part cement to 3 parts sand, makes an excellent job, but the dressing and laying of the stones is sometimes a more lengthy and expensive operation than at first appears.

A good concrete floor is probably the most satisfactory all round if properly laid; it is impervious to moisture, is

wear-resistant, and is easily kept clean. The surface can be sufficiently roughened just before it finally sets to prevent its being too slippery.

The mixture of concrete used should be 1 part cement, 3 parts sand and 6 parts stone. If the aggregate is well graded, a sufficiently even surface can probably be obtained with this mixture if the final ramming is carried out with a rammer having a fairly large flat surface. Otherwise this mixture must be topped with a 1 inch layer of granolithic, a mixture of 1 part cement, 2 parts sand, 4 parts stone chips, the largest of which should pass a $\frac{3}{4}$ inch ring. This layer must be applied while the concrete is still quite green, so that a perfect bond between the two mixtures is obtained.

The total thickness of such a floor should be not less than 4 inches, and this should be laid on a bed of well-rammed hard core (gravel or broken stone) about 6 inches thick. The floor should have a general slope of about 1 in 80 from end to end of the building and the floor of the stall should have a fall of 1 inch from the manger to the manure channel. The central passage should be slightly cambered.

The concrete should be laid in sections not exceeding 10 feet in length, each section being separated from its neighbour by a strip of bituminous felt or mastic cement, to allow the concrete to expand and contract without cracking. These joints should extend right through the manure channels, which should preferably be cast first in the same mixture as the floor, but which must be floated on the inside with a mixture of 1 part cement to 3 parts sand, and brought to a good, smooth surface. These channels should follow the slope of the floor and discharge into suitable concrete or cement plastered brick sumps outside the end of the building, or, if the contour of the ground permits they may connect with a brick and cement lined furrow leading to the dungstead.

All the sand used with cement for concrete and plaster should be clean, sharp river sand, and all cement mixtures should be made in small quantities, so that they can be placed in position within 30 minutes from the time that water is first added to the mixture. After placing, the concrete should be

kept damp with wet sacks or grass for at least seven days or longer if possible. If such a floor is allowed to dry out immediately, it will wear badly and become "dusty."

The manger may be cast either in concrete 1 : 3 : 6 and finished in the same way as the manure channel, or it may be built in brick and finished to the form shown in the drawing with a cement plaster of 1 part cement, 4 parts sand and ½ part lime, brought to a smooth, even surface. The front edge of the manger should on no account be higher than 9 inches above the level of the stall floor. The length of the stall, from manger to manure channel, is shown on the drawing as 5 feet 6 inches, which may be regarded as suitable length for animals of average size, but for small breeds this dimension may be reduced to 4 feet 9 inches and for larger breeds should be increased to about 6 feet. The cows should be able to lie down with their heads over the manger, without having to step back into the trough, but when standing their droppings should fall into the channel.

For further details regarding the mixing and placing of concrete, the reader is referred to the article "Concrete on the Farm," which appeared in the *Rhodesia Agricultural Journal* for April, 1926, and subsequently reprinted as Bulletin No. 588.

Stall Divisions.—The stall divisions may consist of veld poles bolted to short lengths of 3 inch pipe, or light rails driven at least 2 feet into the ground before the floor is laid. Unless the ground is very hard, a small depression should be excavated round them to a depth of about 6 inches, so that they are secured by the concrete floor. If metal uprights are unobtainable, straight poles may be used, but these must not be embedded in the concrete, but let in to slightly tapered holes about 6 inches deep previously cast in the floor, and secured at the top end to the roof rafters, which will be immediately overhead, with ½ inch bolts. This latter method has three distinct advantages, *i.e.*, it is cheap, the poles can be easily removed and replaced, and they help to support the roof.

The top cross rail should be 4 feet from the ground.

Tethering posts consisting of iron piping or light rails may be secured in the floor in the same way as suggested for the supports of the stall divisions, near the front ones of which they are placed, or small slides made of $\frac{1}{2}$ inch diameter round iron, approximately 30 inches long, may be bolted to the front uprights of the stall divisions themselves. These slides should be bent and flattened at their ends in such a way that when they are secured to the uprights, by bolts passing through the flattened ends, they project about 2 inches and run parallel thereto.

Roof.—The roof is carried by a main bearer or plate consisting of a $4\frac{1}{2}$ inch by 3 inch deal or a straight gum or veld pole supported on the pillars and end buttresses.

This bearer, to which the $4\frac{1}{2}$ inch by $1\frac{1}{2}$ inch rafters are secured, must be anchored to the pillars and end walls by means of stout hoop-iron built into the top six courses of brickwork. The wall plate on top of the side wall to which the lower ends of the rafters are secured must be anchored in the same way, and it is as well, while building the walls, to place the hoop-iron immediately below the points where the rafters will come, so that it can be nailed direct on to them and thus make the roof more secure.

Rafters are placed immediately over, and midway between, the pillars, and are therefore 3 feet 9 inches apart.

The roof is made up of lengths of 8 feet and 7 feet iron, and these are secured to five purlins set on their edges, running across the rafters at right angles as shown in the drawing.

The iron is allowed to project well over the central passage to afford as much shade as possible.

Quantities of Materials and Costs.—For the general guidance of readers a schedule of quantities of the various materials required is given, together with the approximate Salisbury prices.

Farm-made bricks are quoted at 12s. 6d. per 1,000, and a small cartage charge only is allowed for the stone and sand.

COW BYRE—TYPE II.

Schedule of Quantities of Materials.

Item.	Number or Quantity	Description	Cost. £ s. d.	Alternative. Number or Quantity	Alternative. Description	Alternative. Cost. £ s. d.
Foundations	4,000	Bricks	2 10 0			
Walls	12,000	"	7 10 0			
Pillars	2,000	"	1 5 0			
Manger, brick ...	700	"	0 9 0			
	2 bags	Lime	0 9 6			
	2 cu. yds	Sand	0 4 0			
	4 bags	Cement	2 3 0			
Manger, concrete	...	...	...	9 bags	Cement	4 16 9
				2 cu. yds	Sand	0 4 0
				4 cu. yds	Stone	0 16 0
Mortar	25 bags	Lime	5 18 9	8 bags	Lime	1 18 0
	11 cu. yds	Sand	1 2 0	3 cu. yds	Sand Dagga	0 6 0
Manure channels	5 bags	Cement	2 13 9			
	1½ cu. yds	Sand	0 3 0			
	2¼ cu. yds	Stone	0 10 0			
Concrete floor ...	22 bags	Cement	11 16 6			
	5 cu. yds	Sand	0 10 0			
	10 cu. yds	Stone	2 0 0			
Stone floor...	...	...	...	14 cu. yds	Stone	...
				12 bags	Cement	6 9 0
				3 cu. yds	Sand	0 6 0
Dampcourse	10 sheets	26 G. gal. flat iron	1 15 0	1 roll	felt 3 ply	2 5 0
Corrugated iron ...	44 sheets	8ft. x 24 G.	8 16 0			
	44 sheets	7ft. x 24 G.	7 14 0			
Hoop iron...	30 lbs.	...	0 10 0			
Screws, bolts, nails etc.		...	3 0 0			

Item.	Section.	Length	Number	Cost.
		Feet		£ s. d.
Wall plates	4½ in. by 1½ in.	12	4	0 10 6
	do.	15	2	0 6 7
Beam supporting roof	4½ in. by 3 in.	8	2	0 7 6
above pillars	do.	15	4	1 8 2
Rafters	4½ in. by 1½ in.	13	18	2 11 2
Purlins	3 in. by 2 in.	16	20	3 3 4
	do.	8	10	0 15 10
Fascia board	6 in. by 1 in.	13	4	0 12 6
Stall divisions, uprights —Bush poles	3 in. butts	11	8	...
	do.	10	8	...
Alternative: Old 3 in. pipe or rails	...	6	16	...
Horizontal rails—Bush poles	3 in. butts	7	24	...

Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants

SUITABLE FOR THE COLONY.

By J. W. Barnes, Manager, Government Forest Nursery, Salisbury.

(Photographs by the Author.)

The following list of trees and plants has been compiled from twenty-three years' experience of horticulture in the Colony. These trees and plants have been actually grown by the writer or have been carefully watched by him.

A large number of species has been tried at the Forest Nursery, Salisbury, during the past twelve years and experiments have been carried out with over one thousand kinds of seeds. The failure of quite a number of these seeds to germinate is attributed to the seed having been too old or to the lack of glass frames in which to raise new or sensitive seeds, which frequently arrive during the colder periods of the year. During the hot or summer season torrential rains are sometimes the cause of seed being washed away or seedlings being damaged.

The list is a comprehensive one and provides useful kinds for all parts of the Colony, and will, no doubt, be of value to people desirous of planting for timber and ornament. This article is more particularly directed to the landscape, or horticultural side of the subject, and one cannot help being struck by the fact that, in this country of large holdings, more is not made of a proper lay-out round homesteads than is the case at present. Most people seem contented with a small shrubbery of formal aspect, whereas much better results would be obtained from a more generous treatment of the subject.

Where there is sufficient space large shrubberies could be laid out, care being taken not to have many straight lines but rather to employ curved banks of shrubs and trees backing lawns, or even the ordinary veld grass, kept cut by the mower.

A judicious use of the larger trees, such as *Cupressus torulosa*, *Eucalyptus citriodora*, and others will help to break up the formal look and give the lay-out a natural appearance.

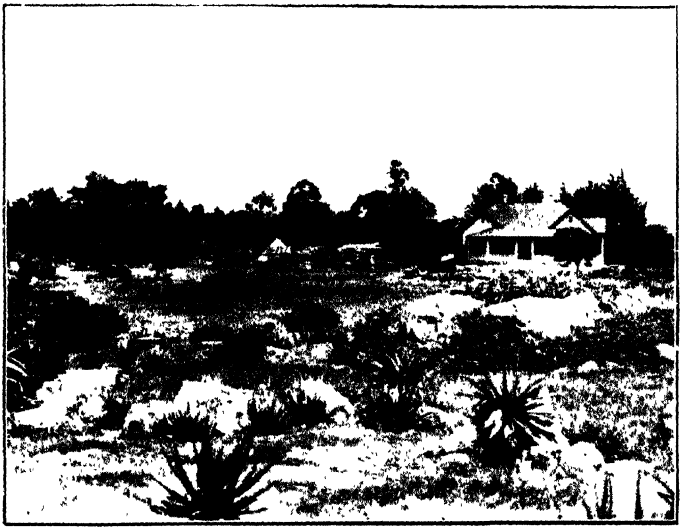
Shrubs and trees for ornament are usually planted too closely together. Near the edge of the shrubbery should come the smallest growers, which may be planted at six feet apart, and farther back the larger shrubs which will require more room, and may be planted from ten to fifteen feet apart. If large trees are to be planted they will require wider spacing. However, all this is dependent on the effect required. If large splashes of colours are required, or deep masses of green, three or four plants of each kind may be planted from six to ten feet apart according to species, in clumps, but care should be taken that each species has room enough to develop properly. When first planted a shrubbery will have the appearance of having too few plants in it, but in a year or two it will be found that the ground is more or less covered.

Preparation of soil for planting is important. Where a plough can be used the soil may be turned up as deeply as possible and should be worked to a depth of eight to ten inches. Even with deep ploughing it is advisable to dig holes eighteen inches square and the same depth, filling in with good surface soil in which some old manure has been mixed.

The soil should be allowed to settle for a month or two. Care should be taken not to plant too deeply. The roots should be just covered. A good soaking of water if the weather is dry is necessary after planting, and grass thrown over the plants for a day or two will help. It should be remembered that plants are living things and can easily be killed, but when treated with respect they will be a credit to the grower.

It does not seem to be generally known that most flowering shrubs prune well, and that good results are obtained by judicious pruning. This operation is best carried out in early September, or just as the buds of Spring growth are breaking. It is a mistake in this hot climate, without a well defined

A scene in the garden of the residence of Mr A. Lockie, Mount Pleasant, Salisbury. This garden was laid out by our former Chief Forest Officer, Dr Henkel, and is an excellent example of landscape work. The hedge is of *Cupressus arizonica*, and has been well kept.



A landscape scene at Munda we Gwenzi ("Garden of flowering trees"), the residence of Sir Ernest Montagu, Salisbury, showing a section of the rock garden and lawns, supported by well arranged backgrounds of trees and shrubs. An excellent object lesson in making the most of the natural lie of the land.

dormant season, to prune shrubs or roses as early as May or June. They should be induced to rest as long as possible by withholding water and pruning. The result of early pruning is to start new growth prematurely and hence the short and unsatisfactory lives of some kinds.

In pruning shrubs it is not necessary to cut back severely unless the future effect would warrant it, and pruning should always be carried out with an eye to the effect desired at the time of flowering. In some cases, only long straggly growth need be shortened.

After the annual pruning there should follow a general dig-over, when the soil is broken up to a depth of at least three inches. It should be left in a rough state to enable air and early rains to penetrate.

Manure should be dug in round the plants within a radius of five feet of each, using it generously if sufficient is available.

During summer months it will be necessary to clean up weeds; these may be hoed up and buried in the shrubbery where in time they will become valuable food for shrubs. Arboreta, or shrubberies, are much the cheapest way of beautifying a homestead, and much less upkeep is required than for the same size of flower garden. This does not, of course, mean that one should dispense with a flower garden. A properly laid our shrubbery will enhance the flower garden, in providing good backgrounds and wind breaks.

A good dressing of lime about every fifth year is beneficial. At least one ton of lime per acre should be used, and in addition common salt in the proportion of one to three of lime is recommended. When lime is used kraal manure must be left out, as these must not be used together.

Hedges.—Most hedging is planted at one foot apart for single line hedges. Single line hedges are the rule, but double row hedges can be used if extra width is required.

The preparation of the trench is important, and will make all the difference between success and failure. Trenches eighteen inches wide and the same depth should, if possible, be dug three months before planting and should be filled in with good surface soil. Subsoil removed from the bottom part

of trench should be discarded. Old manure, leafmould, etc., mixed in the soil will be very beneficial. The trench should be filled in as soon as possible, and left raised about three inches above the surrounding soil level. In two or three months it will have settled down to the proper level, and is then ready for the plants. If the soil is dry at the time of planting a good soaking overnight will put the soil into good planting condition.

The after-treatment of hedges is important. In the case of coniferous hedges, such as Callitris, Cupresses, etc., they may be allowed to grow to the height required before having their tops cut off. Future work with these will be the shaping of the sides as the hedge thickens out and keeping the top cut neatly. In two or three years an excellent and close hedge will result.

With such subjects as Privet, Bottle Brush and Dodonea, the plants require topping when they have become established and half of the top growth should then be removed. Thereafter topping should be a regular operation and as the hedge grows a foot from the last cut, it should be again cut back half way. In this manner a good thick hedge will be built up and will not show bare unsightly sticks at the base. Camphor laurel should be treated not quite so severely as the former kinds. It is a good plan to take the smallest healthy plant in the hedge as a guide, and to shorten back the growth of the others, so that all are brought on about the same size.

All of these hedges are recommended to be planted at one foot apart.

The Bougainvillea, Macartney Rose and Golden Shower make excellent hedges, and make a delightful show when in flower.

The Bougainvillea planted at six feet apart will make a thick hedge, the long shoots as they grow must be tied into the fence wires, and spaced evenly about six inches to a foot apart so as to cover all the space. After the frame work is built up, future treatment will be the clipping off of all growth not required, which is usually done in such a way to keep the hedge about a foot or two wide.

The Macartney Rose can be treated as the Bougainvillea and planted at the same distance apart. This is a particularly fine thorny hedge, and excellent round orchards and places where it is required to keep out cattle. If no blank spaces occur in the hedge nothing will penetrate it. The Macartney Rose makes a cheerful sight in early Spring with its large white single flowers.

Both the foregoing hedges must receive regular attention and as a result will always look neat. If, however, they are neglected they become very unsightly.

The Golden Shower may be planted at nine feet apart along a fence, in large well prepared and well manured holes. As the plants grow the leading shoots can be tied-in, erect to the top of the fence, and then tied down along the top strand of wire as it grows until it reaches the next plant; side shoots from this main stem will then droop to the ground and make a fine showy and neat screen.

Avenue or Street Trees.—The tendency of the past has been to plant street or avenue trees too closely together, and to allow them to branch too near the ground. Such trees as Cedrela, Jacaranda and Flamboyant need to be at least thirty feet apart, and the Flamboyant could be planted at 35 to 40 feet with advantage, as it is naturally a flat topped and wide-spreading treet.

For street planting especially, these trees should be grown with a clear stem to at least seven feet high, before being allowed to form a crown.

The practice in past years has been to let street trees branch more or less where they liked, the consequence being that some trees have formed a crown about four feet from the ground, while others, particularly the Jacaranda, have run up to nearly ten feet. In these days of fast motor transport these trees constitute a real danger, as a clear view is often obscured by low branches. The danger is increased at night. In Salisbury a lot of the trees have had to be pruned severely with the consequent spoiling of the appearance of the trees, however skilfully done. This would not have been necessary had the trees been grown correctly in the first instance. The Flamboyant (*Poinciana regia*), which is now being largely

planted in streets is, as has already been remarked, a very wide-spreading tree, and is very inclined to branch near the ground, unless the branches are removed well up before allowing the crown to form. The Flamboyant may have to be removed in a few years, except in very wide streets.

From experience gained in the past we should endeavour to improve our cultural methods.

Cedrela and Jacaranda can be kept in shape by pollarding all straggly branches. An annual cut back of these would improve their appearance considerably, and prevent branches from encroaching on private stands, and would also keep the tops of the trees in uniform shape. It should be borne in mind that street or avenue trees are meant to provide shade and beauty and when they reach this stage they should be regularly kept in order.

The Spathodea is not so rank-growing as the former. It should be planted at twenty-five feet apart, and taken up to seven feet before heading, and large straggly shoots may be shortened after flowering.

The Bauhinia is not so large and can be planted at twenty feet apart and planted where it can be allowed to form low branches, but it is not really suitable alone. It may be planted as a front line in wide roads where two lines are required and where there is plenty of room between the curb and sidewalks. It would be a pity to discard this tree as it is delightful when in flower.

Grevillea robusta, or Silky Oak, is also used as a street tree, and where it thrives is a suitable tree. However, a good deal of cleaning up is necessary on account of a continual fall of old leaves. Thirty feet would be a suitable spacing for this tree.

It is most necessary to stake securely all avenue trees during the first few years, or until there is no danger of their being blown over by the wind.

In laying out private avenues care should be taken to allow at least thirty feet width of road between the trees. If the trees are required to meet over the middle of the avenue, the Flamboyant or Cedrela will easily cover this distance.

Instances have been seen where only a width of twenty feet or less has been allowed for the avenue, and the trees permitted to branch near the ground, making it often difficult to pass traffic on such avenues.

Should a bottom screen be required for such avenues a double line of Cypress, Callitris, or even Eucalpts, may be planted to provide a screen, but these should be planted at least fifty feet back from the avenue trees to allow them to develop properly.

Specimen trees on lawns, etc., require abundant space in which to grow naturally, and the different species should each be planted in places to suit them. Other small shrubs or rank-growing flowers must not be planted near these while small, as the shade caused may easily damage the lower branches of the specimen, and, of course, a perfect specimen depends on its branch formation for its beauty. To spoil the lower branches is to ruin the look of a specimen tree, and this is particularly so with the Cypress or Araucaria. In the case of specimen trees, like Flamboyant, which have been allowed to have clear stems, flowers may be grown around the base, but stones and soil should not be heaped around these trees, otherwise the tree will be killed in a few years.

Trees should be securely staked until strong enough to stand ordinary winds.

Propagation of Species.—Most kinds of trees and some of the shrubs are easily raised from seed if ordinary care is taken.

The usual practice at the Forest Nursery is to sow seeds in half petrol tins which are ready for use when a few holes have been punched through the bottom.

Soil for the raising of seeds should consist of two parts of good ordinary soil, one part of leaf mould or road sweepings, and one part of sand. This mixed soil should be passed through a quarter inch sieve and the tins filled with it. The tins should be placed on a level surface, and the soil pressed in firmly with the hands and levelled off. The next step is to take a flat piece of wood, or even a brick, and press the surface firmly so that a smooth surface results. Everything is now ready for sowing. The seed should be sown thinly, care

being taken to have an even covering of seed. The seed should be covered, barely out of sight, with a fine soil, which can be prepared from the same soil used for the tins, but put through a piece of mosquito gauze to remove all coarse stuff.

After sowing the tins must be shaded with hessian or grass and kept moist until the seeds germinate. The after-treatment is simply potting up the seedlings when large enough, using the same compost as for the seeds, shading the plants until well established, and then standing them out on a level space in full sunlight. If the plants have been raised in heavy shade it may be necessary to harden them to the sun, gradually.

The golden rule in sowing seed is to cover each species to the depth of the seed only. In the case of fine seeded Eucalyptus this is a mere sprinkling of soil only, and some omit even this.

It is very important that after the first watering the surface of the seed pans must not get dry, even for an hour. On the other hand they must not become saturated with water.

The best times of the year to raise seeds are from March to May and August to November.

Raising Plants from Cuttings.—Some varieties of trees and shrubs which do not seed freely are raised by cuttings, and by cuttings is usually meant ripened wood of the previous season's growth, although young shoots are sometimes struck.

The cuttings may be from six to nine inches long and may be cut off straight at the top, but with an obilque cut below a bud at the base. At least two-thirds of the cutting should be inserted in sand, or three parts sand and one part fine soil. Cuttings may be placed fairly closely together and half a petrol tin cut depthwise will easily take one hundred cuttings.

The tins of cuttings must be moistened frequently, but care should be taken that they do not become too wet; stand the tins in a warm corner in the shade, and in a month or two the plants will be ready for potting up. Some of the cuttings may even then have no roots, but if the base of the

cutting is callused it will probably root. The rooted cuttings should be firmly potted and kept in partial shade until firmly established.

A good time of the year to take cuttings is from July to September.

The mode of propagation of the various species is given in the following list:—

Abelia floribunda.—A hardy shrub up to six feet high, with shining myrtle-like leaves; flowers small pinkish white bell-shaped and produced in profusion in Spring; evergreen when watered during the dry season; is not recommended as a hedge. Hardy. Propagated by cuttings.

Aberia caffra (Kei Apple).—A thorny slow-growing shrub, formerly used for cattle proof hedges; foliage dark green and fruits yellow, being similar in size and colour to apricots; these are edible, and used for preserves. Seeds.

Abutilon sp. (Chinese Lantern).—A well-known shrub with lantern-like flowers variously coloured; will grow to height of 8-10 feet, but is best kept to about five feet by pruning yearly; is not a long-lived shrub, usually dying out in about four years. Will not stand heavy frost. A variegated foliage variety is very handsome. Seeds or cuttings.

Acacia Baileyana (Bailey's Wattle).—A small tree, not very long-lived in the hotter districts, but well worth growing for its beautiful foliage and yellow flowers; height about 15 feet; spreading habit; at its best along the Eastern Border of the Colony. Seeds.

Acacia cultriformis.—A bushy variety, about eight feet in height, with small stiff glaucous leaves; flowers freely, and is very hardy. Seeds.

Acacia dealbata (Silver Wattle).—A similar tree to *mollissima*, but with silvery green leaves; will only do well in the same districts; is inclined to become a pest at Inyanga, as seeds carried by flood water during the rains have carried for miles and have germinted all over the place. Seeds.

Acacia melanoxylon (Blackwood).—A very fine large tree, valuable for its timber; heavy dark green foliage, and insignificant pale yellow flowers; is suitable only along the Eastern Border. Seeds.

Acacia mollissima (Black Wattle).—Is a fast growing tree up to 40 feet in height; dark green foliage; lemon coloured flowers. Grows to perfection only along the Eastern Border or mist belt areas and produces valuable tanning bark. Seeds.

Acalypha macrophylla.—With large blotched leaves about 9 inches x 6 inches in size when well grown; a very handsome variety, showing up well in a dark green background. Cuttings.

Acalypha marginata.—Grown for its ornamental foliage, which is red-green with the margins of the leaves red; height 8 feet; grows best in a partially shaded situation, and should be protected during frost. Cuttings.

Acconcanthera venenata (Poison Bush).—A South African shrub, about 8 feet in height with dark green leaves; branches covered with axilliary, pinkish white flowers; purple plum-like small fruits.

All authorities state that this shrub is very poisonous, and therefore not recommended.

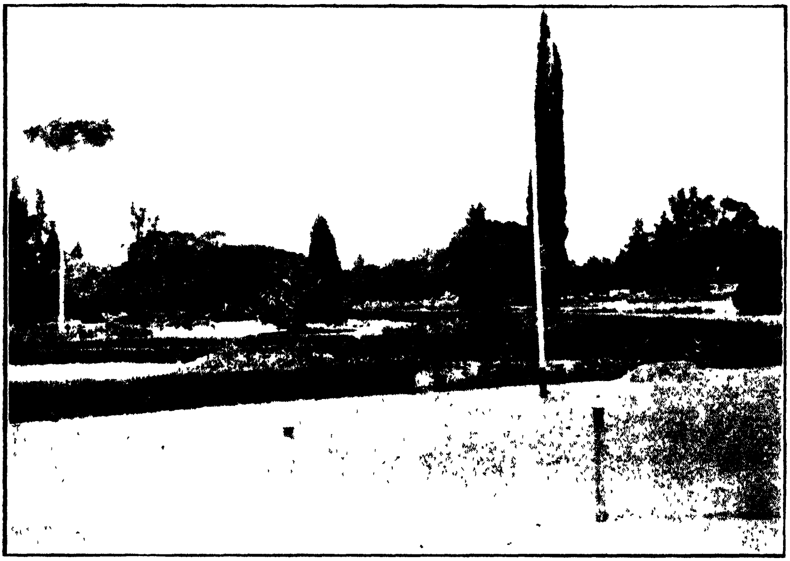
Acrocarpus fraxinifolius.—A medium-sized tree about 30 feet in height; deciduous, spreading crown; resembles Cedrela; is used in some countries as a shade tree for coffee, and it will probably be of use in this country for that purpose. Seeds.

Actinidia chinensis.—A strong-growing, rough climber, with large deciduous leaves, and rather insignificant pale yellow flowers; said to bear an edible fruit, but our plants at the Forest Nursery have so far been males. Seeds.

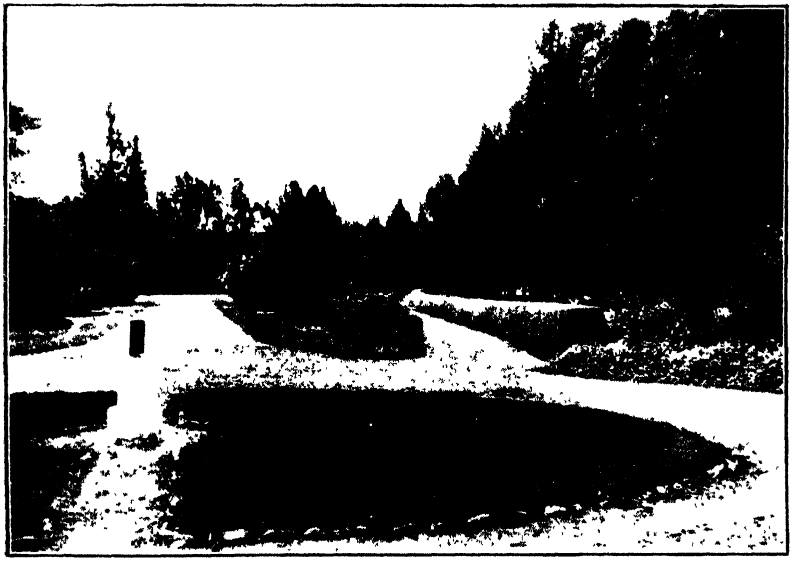
Adhatoda duvernoia (Pistol Bush).—An evergreen shrub, 6 to 10 feet in height, tender to frost, and with pinkish-white flowers. Cuttings.

Agapanthus umbellatus (African Lily).—A well known plant, which although not a shrub, is usually used in shrubbery work, where it is very useful near the edges of the shrubbery. Seeds or offsets.

Agave americana (Aloe).—The American aloe with large leaves which are glaucous-green and fleshy; useful on rockeries and in shrubberies. Suckers. A variegated variety which is very showy is used in shrubberies.



A landscape scene in the Public Gardens, Salisbury. On left *Schizolobium excelsum*, on right *Cupressus sempervirens-pyramidalis*



GOVERNMENT FOREST NURSERY, SALISBURY

A scene at the nursery, showing on right a hedge of bottle brush (*Callistemon speciosus*), properly built up and thick. This hedge was made from a line of trees eight feet high, and was cut near the ground to make the trees branch out; the cypress trees on the right are too close to the hedge for the best results.

Agave rigida (Sisal).—Both the plain and spiny-leaved kinds grow to perfection; leaves from three to five feet in length; are very useful for thatching and tying purposes. Natives crush the leaves slightly and strip them down to make "tambo," which for thatching purposes lasts as long as the thatch. Bulbils or suckers.

Aleurites fordii (Tung Oil).—This tree was first raised in Salisbury in 1923 and one or two trees six to eight years of age have grown slowly; a large deciduous tree with large maple-like leaves, and bearing a nut similar to the chestnut, from which a valuable oil is extracted. Will probably be found to thrive best in the Melsetter area. Seeds.

Aleurites montana.—Similar to *A. fordii*, and to which the same remarks apply.

Aleurites triloba.—One or two trees of this have done very well in Salisbury, planted about twenty years ago, and one tree now about 30 feet in height and very healthy. Seeds. Propagation difficult.

Allamanda grandiflora.—A beautiful golden flowered variety, and a strong climber, suitable as a verandah climber. Cuttings. Propagation difficult.

Allamanda neriifolia.—A shiny leaved shrub, 3 to 6 feet high, with bell-shaped yellow flowers. Evergreen. Seeds or cuttings.

Allamanda violacea.—A very fine violet-purple variety of rather small size, being about 4 feet high, best treated as a shrub, any long shoots being tied in, or cut back. Cuttings. Propagation difficult.

Althæa sp.—A small shrub up to 6 feet high, allied to Hibiscus; several varieties, some with single flowers, light purple and white, others with double flowers; found to do best in partial shade. Hardy. Deciduous. Cuttings.

Aloysia citriodora (Lemon Scented Verbena).—A small bush usually about 4 to 6 feet; flowers insignificant, white; grown for its scented foliage. Deciduous. Cuttings.

Alstonia scholaris.—A small shrub about 6 feet in height; resembling oleander, with bunches of pure white flowers, evergreen. Seeds.

Ampelopsis quinquefolia.—A large-leaved variety, of much coarser habit than *A. veitchii* and very hardy. Seeds and cuttings.

Ampelopsis veitchii (Virginia Creeper).—A climbing plant suitable for walls and rocks, to which it clings; proved to do best in this country on south walls. Seeds or cuttings.

Anona reticulata (Custard Apple).—A small tree, deciduous, with excellent edible fruits; seems to thrive and fruit best if the seeds are sown "*in situ*." Seeds.

Antigonon leptopus (Coral Creeper).—A beautiful sight when a large plant is in full bloom; strong grower, deciduous and rather unsightly during the winter, unless grown with some other evergreen climber which will not kill it. Seeds.

Araucaria bidwillii.—Very different in habit from *A. excelsa* and *A. cookii;* it has short, stiff sharply pointed leaves, very similar to the true monkey puzzle (*A. imbricata*).

A. bidwillii has grown well in Bulawayo; Araucarias are very hardy with the exception of *A. imbricata,* which has failed. All Araucarias raised from seeds.

Araucaria brasiliensis.—A tree similar to the true Monkey Puzzle, *A. imbricata,* and a handsome specimen tree. Some have survived in Salisbury, and a few trees are to be seen about 20 feet high; this tree, however, is inclined to die out in hot districts, but will undoubtedly do well in the Eastern Border Districts.

Araucaria cookii.—A similar tree to *A. excelsa.*

Araucaria cunninghami (Moreton Bay Pine).—Has glaucous foliage and is not of such formal growth as other Araucarias owing to the branches having a more tufted appearance.

Araucaria excelsa (Norfolk Island Pine).—A large tree which will probably grow to a height of 100 feet; is used chiefly as a centre piece for lawns, and is a fine tree for use in large landscapes.

Aristolochia elegans.—Not so strong-growing as *A. sipho,* and with much smaller, brownish-red, flowers. Seeds.

Aristolochia sipho (Dutchman's Pipe).—A strong climber, growing to a height of 25 feet, with curious flowers, of a purplish colour. Hardy. Seeds.

Aristolochia tomentosa (Dutchman's Pipe).—A strong grower, requiring plenty of room; crimson-purple flowers. Deciduous. Seeds.

Arundo donax (Spanish Reed).—A strong reed, up to 25 feet in height in a good soil with plenty of moisture; has a diameter of an inch and is very useful for garden sticks and numerous other purposes. Offsets. A variegated variety is very ornamental.

Asparagus plumosus (Asparagus Ferns).—This plant grows to perfection with very little effort, and varieties are to be found growing in the veld. Seeds or divisions of roots.

Asparagus sprengeri.—A useful kind for hanging baskets; fronds about two feet in length and has at one period of the year tiny white flowers. Scented. Divisions of roots or seeds.

Bambusa arundinacea (Whipstick Bamboo).—The stems of this species are up to 50 feet, when grown in heavy rich soils and have diameters up to 5 inches; for whipsticks it should be grown in poor or gravelly soil. Offsets.

Bambusa fortunei (Fortune's Bamboo).—A small variety having a height of about 6 feet and stems about half an inch thick; valuable in clumps in a shrubbery and can also be used as a hedge; stems are very handy as stakes in a garden. Offsets.

Bambusa vulgaris.—A strong-growing bamboo, with blackish stems 2 to 3 inches in diameter, and 15 feet high. Offsets.

Bambusa sp. (Striped Bamboo).—Height to 15 feet, diameter 3-4 inches; has golden stems marked with green stripes. Offsets.

Bambusa sq.—An Indian species raised from seed brought over by Mr. A. C. Laurie, Glendale, and though not yet fully grown has reached 20 feet in height. Offsets.

Bauhinia acuminata.—A pure white variety similar to *B. purpurea*, and used for the same purposes. Seeds.

Bauhinia galpini (Pride of the Cape).—Should be called Pride of Rhodesia, as it occurs abundantly in portions of the Colony. There are several indigenous Bauhinias.

This a rambling, climbing shrub and loves to climb over other trees, where it will reach a height of 30 feet; flowers are terra-cotta coloured and shaped like nasturtiums; when in bloom is very effective. Hardy. Seeds.

Bauhinia purpurea.—A small showy tree 15 to 20 feet in height, with Rhododendron-like flowers, which are pinkish-mauve in colour and scented; flowers May-July, at a time of year when there are otherwise few flowers. It is used for streets and avenues, when it should be planted at 20 feet apart, and is also a very fine small tree for shrubberies. Seeds.

Beaumontia grandiflora. — A large-leaved, vigorous climber, which requires plenty of room. One plant will easily cover a trellis 25 feet in length and 10 feet high; a quick grower, and flowers profusely; flowers large, trumpet-shaped and pure white, being very similar to *Lilium Harrisii;* sometimes a little slow in becoming established. Seeds.

Bignonia cherere.—A beautiful large flowered reddish-orange species; strong grower and climber. Propagation by layers, or budding.

Bignonia gracilis.—A climber which will cling close to walls and trees, like Virginia Creeper, and is very useful where a plant is required to cover a dead tree stump. Has large sulphur yellow flowers, but only in flower for a short period yearly. Cuttings or seeds.

Bignonia jasminoides.—A good climber which has evergreen bright shining leaves and large white flowers with purple throat. Seeds or cuttings.

Bigonia speciosa.—A dwarf ground runner 2-3 feet in height and having mauve flowers. Cuttings.

Bigonia venusta (Golden Shower).—Grows to prefection nearly everywhere; this gorgeous climbing plant is too well known to need description. Excellent alike for verandahs, pergolas, or even as a hedge, when it makes a wonderful show. Cuttings.

Bixa orellana (Arantto).—A dark green shrub, 6-8 feet in height with rather pretty pink flowers; dense foliage; evergreen. A dye is obtained from this which is used in colouring cheese. Seeds.

Bolusanthus speciosus (Rhodesian Tree Wistaria).—A small indigenous umbrageous tree, 15-20 feet high, covered in Spring with panicles of intensely blue flowers similar to the Wistaria, but smaller. Seeds.

Bougainvillea splendens.—This species and several others of this genus do remarkably well, and are useful as strong climbers; if trimmed into neat bushes, they make effective shrubs, and also make excellent hedges if kept in order. Layers or cuttings.

Brugmansia knightii (Moonflowers).—Makes a fine shrub 10-15 feet high. It has large single highly-scented flowers during summer. It requires protection in winter while small, as heavy frosts cut it back. A double variety is also grown, but not so strong in growth, height 6 feet. Seeds or cuttings.

Brunfelsia americana.—A small bush up to 6 feet in height. A variety with whitish-yellow flowers, over an inch in diameter; flowers in early Spring. Cuttings.

Brunfelsia eximia (Yesterday-To-day-To-morrow).—The uncommon name of this plant is owing to the fact that the flowers turn a different colour daily. They are at first a fine violet-purple. A small slow bush, up to about 6 feet in height, but a beautiful sight in early Spring when covered with flowers which are also scented. Seeds or suckers.

Buddleia sp.—Several varieties of Buddleias are grown, and thrive, some with blue to purple flowers; flower in the Spring, and grow up to 10 feet in height.

An orange-flowered species grows rankly to a height of 15 feet and flowers in June-July. Flowers sweetly scented.

An indigenous variety, *B. salviæfolia*, flowers in May-July, and has pinkish-purple scented flowers, and is a common shrub on the Eastern Border. Seeds or cuttings.

Callistemon speciosus (Bottle Brush).—A small tree up to 20 feet in height with bright red flowers; the tree has a weeping habit, and is a graceful object when well grown. It makes a good hedge, but must be clipped regularly by starting

near the ground, to make a thick hedge. Also in use for avenues, where it should be planted at 20-25 feet apart. Hardy. Several other varieties have all been grown with success from seeds.

Callitris calcarata (Black Cypress Pine).—A small tree to about 40 feet, excellent for grouping effects; a useful species for timber or landscape and used also for hedges. Seeds.

Callitris glauca.—Very similar to *C. robusta;* good in the hot districts but not on diorite. Hardy. Seeds.

Callitris rhomboidea.—Has been used as hedges only. Seeds.

Callitris robusta (White Cypress Pine).—Growing to 30-40 feet high; is a very good timber and ornamental tree, has glaucous foliage. Hardy. Seeds.

Callodendron capensis (Cape Chestnut).—Discovered to be indigenous to this Colony. It is a fine flowering tree, with white spotted purple flowers, but is rather slow in cultivation. Seeds.

Calpurnia aurea.—A small shrub about 6 feet high, with laburnam-like yellow flowers. Seeds.

Cæsalpinia sepiara (Mauritius Thorn).—An extremely strong-growing thorny shrubby half climber, mimosa-like leaves, and very handsome heads of yellow-red flowers. It makes excellent cattle proof fences and requires plenty of room. Seeds.

Carica papaya (Paw Paw).—A large herbaceous plant up 15 feet in height, and bearing a well-known fruit; a short-lived plant; and requires renewing every 3 or 4 years for the best results. Tender to frost. Seeds.

Carissa grandiflora (Amatungula).—Thorny bush with dark shining foliage, deciduous here unless watered, bears small purple plums which are edible. Seeds. Other species are indigenous to the Colony.

Caryota urens (Fish Tail Palm).—A very handsome palm growing to over 20 feet. Seeds.

Casimiroa edulis (Mexican Apple).—An extremely fast-growing large evergreen tree, height 30-40 feet, dense foliage, weeping habit, and with an edible fruit rather larger than a golf ball. Seeds.

Cassia capensis (Cape laburnam).—A showy yellow-flowered shrub which flowers profusely in the Autumn; about 6-8 feet high. Hardy. Seeds.

Cassia siamea.—A small evergreen tree, about 25 feet in height, with bright green shining leaves, and heads of pale yellow flowers. It is very tender to cold when young and must be protected. Seeds.

Castanospermum Australe (Australian Chestnut).—A fine shade tree resembling Cedrela, but with bright shiny foliage, bearing orange-red flowers produced close to the stems, in early Spring. Hardy. The best results will probably be obtained by sowing *in situ.* Seeds.

Casuarina cunninghamiana (Beefwood).—A very hardy tree and will thrive in most unlikely places. Seeds.

Cedrela odorata.—A similar tree to the toon, but not so hardy in the young stages, requiring protection for the first winter; both by seeds.

Cedrela toona (The Toon).—A large shade and timber tree introduced in 1910; thrives to perfection in the heavy soils, and is used most extensively for street work, where it is planted 20 feet apart, which is too close; should be at least 30 feet apart; the timber is an excellent cabinet wood. Very hardy.

Ceratonia siliqua (Carob Bean).—Has been grown in the Umtali District and tried elsewhere; a small evergreen tree, 20-30 feet in height, bearing the beans known as locust beans, an excellent stock feed; trees are a little difficult to establish. Seeds.

Cestrum aurantiacum (Ink Berry).—A large shrub up to 10 feet high, with orange yellow tubular flowers. Cuttings.

Cestrum elegans and other kinds also do well. Cuttings.

Chamærops elegans.—A slow-growing, but useful palm, has fan-shaped leaves; has reached 10 feet in height. Seeds.

Chamærops excelsa.—A palm similar to above. Seeds.

Clerodendron fallax.—A small shrub, about 3 feet in height; makes a wonderful show with its scarlet flowers. Cuttings or seeds.

Clerodendron thompsonæ or balfourii.—A hardy climber, best grown on a wall; has bright flowers of pure white and scarlet. Cuttings.

Clitoria ternatea (Mussel Shell Creeper).—A strong climber, with delightful blue flowers. Seeds or cuttings.

Cobæa scandens.—A strong climber, and will cover considerable space; reddish-purple flowers and very useful where a quick climber is needed. Seeds.

Cocos plumosa.—A fine palm, tall-growing, with large feathery leaves. Seeds. Difficult to germinate.

Cortaderia argentea (Pampus Grass).—Growing to 8 feet high, is a handsome plant, with its long plumes of white seed heads; best grown near a leaky tap, or in the water garden. Offsets.

Cratægus coccinea (Hawthorn).—Growing to about 6-8 feet, is a showy shrub when in berry. Deciduous, white flowers, berries golden red. Seeds.

Cratægus oxyacantha (Hawthorn).—Shrubby tree, height 10 feet, deciduous, covered with orange-red berries during the leafless period. Seeds.

Cratægus pyracantha (Hawthorn).—An evergreen spinose shrub, dark green foliage, small white flowers, scarlet berries; makes an excellent hedge. Seeds.

Crotalaria Juncea.—This well known plant is the Sunn-hemp, and is used extensively for green manuring; all Crotalarias propagated by seeds.

Crotalaria sp.—Some are fair-sized shrubs, and others small plants with yellow flowers; several species are indigenous to the Colony.

Croton sylvaticus (Mount Selinda Linden).—An indigenous tree from the Eastern Border, broadleaved, deciduous; a good shade tree up to 30 feet in height. Seeds.

Avenue Trees.—Showing correct method of growing avenue trees Grown two seasons to obtain a tall, strong, single stem, now ready to cut back to form a crown. This will be cut off atmark seven feet from ground, and four to six shoots allowed to develop from the top foot of stump.

Cryptomeria elegans.—A smaller tree than *E. japonica,* but also a very valuable tree on the Eastern Border; foliage turns a beautiful fiery red in Autumn; for the wet districts only. Seeds.

Cryptomeria japonica (Japanese Cedar).—A coniferous timber tree, which has grown to over 40 feet in height; a handsome specimen tree; will become a valuable tree on the Eastern Border, but most other districts are too dry for it. Seeds.

Cryptostegia grandiflora.—A rough and strong half climber, but usually grown as a shrub, has fine pinkish-mauve trumpet-shaped flowers, and shiny green foliage. Seeds.

Cupressus arizonica (Arizona Cypress).—A very hardy Cypress suited to the hot districts; a good hedge variety.

Cupressus funebris.—A hardy small tree for the warm districts; slow in growth.

Cupressus Lawsoniana.—A very handsome variety; for the wet districts.

Cupressus lusitanica (Portuguese Cypress).—It is the most successful species of Cypress in the heaviest rainfall areas, growing almost like a weed on the Eastern Border; it is inclined to die out during the dry winters in the warmer districts.

Cupressus sempervirens horizontalis.—A variety which does well and is very hardy.

Cupressus sempervirens pyramidalis (Chimney Cypress). —A tall Italian Cypress; very successful in Mashonaland.

Cupressus torulosa (Himalayan Cypress).—A most successful tree in Mashonaland, and also doing well in the driest timber and ornament.
parts of Matabeleland; this handsome tree is widely used for

All the above Cypresses are raised from seeds.

Cyathea dregei (Tree Fern).—Many thousands are to be seen, standing like long lines of sentinels, on the Inyanga plateau, and show where there is running water; they range from a few inches to 15 feet in height; can be grown successfully in tubs, but require a sheltered verandah away from the prevailing winds, when cultivated. Plants.

Cydonia japonica (Flowering Quince).—A deciduous small shrub about 4 feet; flowers appear very early in Spring, about August, before the leaves, and are red in colour; useful for cutting. Cuttings.

Cyperus papyrus (Papyrus Grass).—Indigenous to the Colony; this handsome grass will thrive if planted near a leaky tap, and will reach a height of 10 feet in suitable places. Offsets.

Cyphomandra betacea (Tree Tomato).—A large shrubby herbaceous plant, about 6-8 feet in height, bearing edible fruits; plants must be renewed every few years; tender to frost. Seeds.

Dahlia imperialis (Tree Dahlia).—A tall perennial dahlia, about 8 feet in height; has fine heads of large single flowers, of a pinkish-white and is useful in a large shrubbery. Dies to the ground each year after flowering. Hardy. Seeds.

Dais cotinifolia.—A small tree producing small heads of lilac-like flowers; has grown to 10 feet high. Difficult to propagate.

Datura arborea (Potato Tree).—A large shrubby tree, very fast grower, height to 30 feet, flowers profusely, large bluish-purple. Tender in the young stage, leaves have strong thorns when young, but these disappear from the leaves as the tree gets older. Has large apple-like fruits which are probably poisonous. Seeds.

Dendrocalamus strictus (Bamboo.)—A useful solid stemmed bamboo; about 15 feet in height and diameter of one inch; narrow leaves. Offsets.

Deutzia crenata (Bridal Wreath).—A small growing bush here, about 5 feet, with masses of double white flowers, tinged with pink. Cuttings.

Deutzia vilmoriana.—Similar, but with single white flowers. Cuttings or seeds.

Dodonea viscosa.—An indigenous shrub from the Eastern Border; has bright green narrow leaves, and will make an excellent hedge, but dies out after a few years in Mashona-

land, but curiously enough it is about the best long-lived hedge in Bulawayo, where one would think it would not do at all. Seeds.

Dombeya sp.—Two varieties do well; one, a large shrub, has pale pink paper-like flowers; the other, a small shrub with deep rosy-pink flowers. Cuttings.

Dracæna reflexa.—A large species, growing to a height of 20 feet, leaves bright green, long and broad; excellent in the shrubbery for its tropical effects. Seeds or cuttings.

Duranta plumieri (Three Forget-me-not).—Growing to about 15 feet high; there are several kinds growing well, some are very thorny, others without thorns; all have flowers practically the same in colour—blue. Also a white variety. Cuttings.

Eriobotrya japonica or *Photinia japonica* (Loquat).—The well known shrubby tree, producing yellow edible fruits in the Autumn. Seeds.

Erythrina caffra (Kaffir Tree).—A well known large indigenous tree with coral red flowers. Easily raised from seeds, or truncheons.

Erythrina crista-galli.—A small variety, about 4 feet high, usually sending out new growth each year from the base; has terminal spikes of red flowers. Seeds.

Eucalyptus Species.—The following species have been tried, and the district in which they have done best is stated.

E. amygdalina (Peppermint Gum).—Eastern Border. At Inyanga a good tree, tender to frosts while small.

E. botryoides.—Has grown well in Mashonaland on deep soils, and on Eastern Border.

E. calophylla.—Eastern Border, a good ornamental tree, about 20 feet in height.

E. citriodora (Lemon-Scented Gum).—Poor on Eastern Border, excellent in parts of Mashonaland. Sometimes tender to frost while small.

E. coriacea.—Has thrived on the Eastern Border, but not a good tree.

E. cornuta.—A small tree. Only on Eastern Border.

E. crebra.—Fails in wet districts, fair in Salisbury, fairly good at Bulawayo.

E. diversicolor (Karri).—A few planted at Inyanga justify further planting there.

E. ficifolia (Red-Flowered Gum).—Good on Eastern Border, but cannot be considered a successful tree away from the wet districts.

E. globulus (Blue Gum).—Grown to perfection on Eastern Border, and wet areas; was also grown there successfully from seed sown *in situ*, 2 lbs. per acre; in five years, poles 45 feet in length were being cut out from these sowings.

E. hemiphloia (Grey Box).—Fair in the hotter districts.

E. longiflora (Wooly Butt).—Fair in Salisbury, probably do well on Eastern Border.

E. maculata (Spotted Gum).—Very fine trees at Umtali, fair tree in Salisbury, poor on Eastern Border mountains, yet excellent at Umtali where the altitude is much lower.

E. maideni (Maidens Gum).—Is doing well in the Midlands.

E. melliodora (Yellow Box).—A poor tree in Salisbury, better in Matabeleland.

E. microcorys (Tallow Wood).—Grown to perfection on Eastern Border; a small tree in Salisbury.

E. paniculata (Ironbark).—Grows well on Eastern Border, but is easily damaged by strong winds, does fairly well in the hotter districts; a good avenue tree.

E. pilularis (Black Butt).—A very fine tree on Eastern Border, and is a fair tree in Salisbury; tender to frosts when small.

E. polyanthema (Red Box).—Would make a good avenue tree in the warmer districts.

E. punctata (Leather Jacket).—Doing well on Eastern Border.

E. resinifera (Red Mahogany).—A very fine tree on Eastern Border, or wet districts, but not so good alsewhere; a

large flowered type of this, *E. hemilampra*, has done remarkably well at Inyanga, where it has reached 70 feet in height in about 15 years.

E. robusta (Swamp Mahogany).—Doing well on Eastern Border, but only a small straggling tree in warmer districts.

E. rostrata (Red Gum).—One of the hardiest and best trees for the hot districts, doing well nearly anywhere if the soil suits it, but fails on Eastern Border.

E. saligna.—A very fine tree where there is a fair rainfall and deep soil, one of the best on Eastern Border; this tree has become mixed up with *E. grandis*, and most of the trees grown in Rhodesia are of the latter species; both do well in the wet districts.

E. siderophloia.—A success on the Eastern Border.

E. sideroxylon (Red Ironbark).—A fairly good tree in the warm districts.

E. stuartiana.—A good tree at Inyanga.

E. tereticornis (ForestRed Gum).—Shares with *E. rostrata* pride of place as the hardiest gum for general planting, but of no use in the mountain areas.

E. viminalis (Manna Gum).—Has done fairly well on sand veld around Salisbury. All the Eucalypts are raised from seed.

Eugenia braziliensis (Brazilian Cherry).—A small shrub useful for its fruit, which is made into a jelly; has been used as a hedge plant, but unsuitable as it is deciduous; excellent for game. Seeds.

Euphorbia fulgens or *jacquiniæflora.*—A beautiful variety, growing best on the sand veld; attains to about 6 feet high; has small star-shaped orange-scarlet flowers. Cuttings.

Euphorbia splendens (Christ Thorn).—A useful small thorny bush, 18 inches in height, usually covered with bright red flowers; is a useful and showy edging to small borders, or in the shrubbery. Also a large-leaved variety. Cuttings.

Exochorda grandiflora.—A shrub, has reached 6 feet so far, producing large pure white flowers, similar to mock orange, in early Spring and before the leaves appear. Seeds or cuttings.

Ficus capensis.—An indigenous fig, growing into a large evergreen tree. Seeds or cuttings.

Ficus macrophylla.—This is a fine evergreen fig, making a large shade tree, and thrives on very poor soil; will grow to 25-30 feet in height, and is inclined to branch close to the ground, but if pruned up can be made into a first-class specimen. Hardy in hot districts. Seeds.

Ficus religiosa (Peepul Tree).—A large handsome tree, very tender to frosts while small. Seeds.

Ficus repens.—A clinging fig, suitable for stonework or walls, to which it clings very closely; small leaves; evergreen; the young leaves are a brownish red, which is very attractive. Cuttings.

Ficus retusa.—A large spreading tree; evergreen with small shining leaves; very hardy; thrives at Bulawayo on practically pure sand. Large surface roots are rather a drawback. Cuttings or layers.

Ficus sub-calcarata.—A large, dark-green-leaved fig, indigenous, making a fine large and spreading tree. Seeds or cuttings.

Fourcroya gigantea (Mauritius Hemp).—Grows to perfection; has long leaves similar to *Agave rigida*, but of a yellowish-green colour, and about 5 feet long; the flowers are produced on long poles 15-20 feet in height, and are white; these are attractive in February-March and show up well in a large shrubbery. Suckers or bulbils. A variegated variety, is very ornamental.

Freylinea tropica.—A small indigenous shrub from the Eastern Border, about 6-8 feet in height, has small plumbago-like flowers; evergreen where it can obtain water; makes an excellent close hedge, but must be watered during the dry season. Seeds or cuttings.

Galphimia gracilis.—A small shrub, with yellow flowers; has been used as a small hedge. Seeds or cuttings.

Gardenia florida.—Heavy glossy foliage, and highly scented double white flowers; this is a good shrub, but likes plenty of water. Cuttings.

Grevillea caleyi.—A small tree, or shrub; evergreen; height about 8 feet; has red flowers. Seeds.

Grevillea robusta (Silky Oak).—A medium sized tree; evergreen; not very successful in Mashonaland where it is inclined to die back, but is used as a street tree in Matabeleland; is also used as a shade tree for coffee. Seeds.

Hamelia patens.—A fair sized shrub; evergreen where it can be watered; dark green foliage; orange-yellow flowers, followed by small blue berries. Cuttings.

Hedera helix (Ivy).—Too well known to need description; the ivy needs shade and cool conditions, even then is not very successful here. Cuttings.

Heliotrope sp.—Small garden shrubs; good varieties may be raised from seeds, which vary in colour and size; sweetly scented flowers of a lavender colour. Seeds or cuttings.

Hibiscus mutabilis.—A hardy shrub growing to 10 feet high, inclined to straggle; has large single pink flowers, similar to the single hollyhock. Seeds or cuttings.

Several varieties of Hibiscus occur in this Colony, including *Hibiscus cannabinus*, which is a valuable fibre plant, and is to be found in most parts of the Colony, growing in places to 10 feet in height. Seeds.

Hibiscus rosa-sinensis.—This Hibiscus is too well known to need description; is used as hedges and as large shrubs. Several colours are in cultivation here, some with single, and others with double flowers. Cuttings.

Holmskioldia sanguinea.—A strong grower, to 10 feet in height, producing red papery flowers on long spikes, in March-June; very valuable as cut flowers. Cuttings.

Holmskioldia sp.—A yellow-flowered variety exactly similar to *Holmskioldia sanguinea.* Cuttings.

Hovenia dulcis.—A small tree; has grown fairly well, but seems to have nothing to recommend it.

Hydrangea japonica.—Small shrubs up to 4-6 feet in height; doing well in sheltered situations, and when well watered; also suitable as a verandah shrub in tubs. Cuttings.

Hymenosporum flavum.—A medium sized flowering tree, about 20 feet with rather scanty foliage and bearing trusses of large whitish-yellow scented flowers in spring. Seeds.

Hypericum lanceolatum (St. John's Wort).—A shrub indigenous to the Colony, rather large, deciduous away from the Eastern Border; has attractive orange yellow flowers, and flowers profusely. Cuttings or seeds.

Hypericum quartinianum.—Another variety indigenous to the country, with flowers similar to *H. lanceolatum*; smaller than the former in growth. Cuttings or seeds.

Iboza riparia or *Moschosma sp.* (Rhodesian Spirea).—A medium sized indigenous shrub; has aromatic leaves and large spikes of small blue flowers, flowering during the winter months; deciduous. Cuttings.

Iochroma tubulosa.—Of the Solanaceæ family; this is a shrub about 10 feet in height, and has deep blue tubular flowers about an inch and a half long; showy. A scarlet variety is very effective. Cuttings.

Jacaranda mimosæfolia.—Too well known to need description as is it grown by nearly everyone; used extensively for street work, and during the flowering period, September-November, the town of Salisbury is a blaze of lavender coloured flowers. This tree is tender to frosts and should be protected until it has reached a height of 5 feet. Seeds.

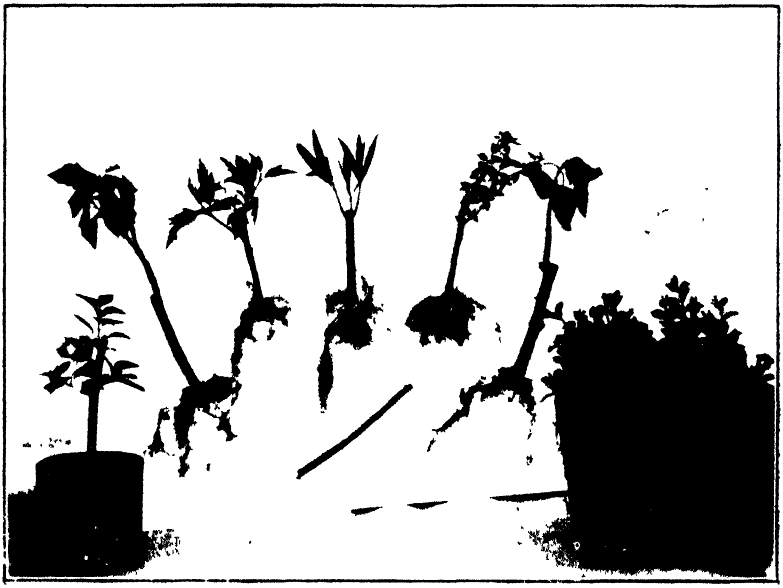
Jasminum primulinum.—A yellow flowered climbing shrub which is rather untidy unless kept tied in and trimmed. Hardy. Cuttings.

Jasminum sambac.—A strong and hardy evergreen semi-rambling shrub, with clusters of large white flowers. Cuttings.

Jatropha coccinea.—A handsome shrub, producing scarlet flowers and pretty foliage; is tender to frosts; the fruits are probably poisonous. Seeds.

Jatropha curcas (Purging Nut).—Has grown to 9 feet in height in three years, with a spread of 7 feet, and this year has produced 5 lbs. of seed. Is probably of economic value; tender to heavy frosts. Seeds.

Juniperus procera (Kenya Cedar).—A valuable timber tree from Kenya Colony, but is probably only useful in the warmer districts here for the shrubbery; has reached a height of 6 feet in four years. Should do well on Eastern Border. Seeds.



Cuttings of various flowering shrubs properly rooted. Tin of cuttings on right about ready for potting up; at this stage they will have very little root and should be potted up several in a tin and planted deeply. On left, after properly rooted, potted into separate tins and just above the good root system.

Juniperus virginiana.—Useful small tree with valuable timber; a very suitable conifer for the shrubbery in all districts.

Also *Juniperus Bermudiana.*—Seeds.

Kentia belmoreana or *Howea belmoreana* (Curly Palm).—Handsome palms; require protection of shade house or verandah; there are other species of the same genus. Seeds.

Kerria japonica.—A small shrub about 4 feet with pretty orange-yellow double flowers; flowers in summer. Cuttings.

Khaya nyasica (Banket Mahogany).—The largest indigenous tree in the Colony, and producing a valuable timber; only to be grown as large timber where there is plenty of moisture; has reached a height of 30 feet in 15 years at Salisbury. Seeds.

Kniphofia rooperi.—Commonly called Red Hot Poker; an indigenous aquatic plant found growing in vleis or wet ground; can be grown successfully near a leaky tap, or water garden; division of roots.

Lagerstrœmia indica (Pride of India).—Also called the Crepe Flower; there are white, pink and mauve varieties; leaves turn red before falling. They are rather large shrubs, reaching a height of 15 feet; the best heads of flowers are obtained by annual pruning; very hardy. Cuttings.

Lagerstrœmia regina.—A small shrubby tree with much larger leaves and flowers than *L. indica;* of a mauve colour; hardy. The leaves have fine Autumn effects before falling. Cuttings.

Lagunaria patersonii.—An evergreen tree 25-35 feet in height, producing pretty pink flowers; not very successful in Mashonaland, but does well in Matabeleland, where it is used as a street tree in Bulawayo. It is rather dangerous for children, as the numerous seed capsules contain countless small irritating hairs. Seeds.

Lantana salviæfolia.—Grows to 18 inches at the most, and is useful for edgings; has pretty pink flowers; does not seed; useful on rockwork; hardy. Cuttings.

Lantana sp. (Cherry Pie).—A straggling shrub; the common colour of the flower is orange and red; grows like a weed; has been used as hedges, but is not now recommended,

as the seeds are carried by birds and the shrub germinates everywhere, and is liable to become a serious pest. A white variety grown does not seed freely, so is safe to plant, and is worth growing. Cuttings.

Lasiandra macrantha or *Pleroma macranthum.*—A small shrub 6 feet hight; evergreen; has beautiful large purple flowers, the bush is easily damaged by high winds, and is inclined to die out after a few years. Cuttings.

Latania borbonica or *Livistona chinensis* (Bourbon Palm).—A handsome fan palm, suitable for the verandah or sheltered position outdoors. Seeds.

Leucæna glauca.—A small bush growing to 6 feet high and bearing small whitish flowers; this shrub was introduced for trial as a stock feed, for which it may be of some value. Seeds.

Ligustrum lucidum (Chinese Privet).—A very good species for hedges, especially in heavy vlei soils, or where it is rather wet; to make a dense hedge it must be cut back regularly from near the ground up, or it will be too thin later on. Seeds.

Lonicera periclymenum (Common Honeysuckle).—A very hardy and rapid climber, flowering freely; needs regular attention to keep it neat. Cuttings.

Lonicera sempervirens (Trumpet Honeysuckle).—A rapid climber; hardy; evergreen; scarlet flowers in profusion; flowers long tubular trumpet shaped. Cuttings.

Also yellow variety similar to above. Cuttings.

Maclura aurantiaca (Osage Orange).—A very thorny and strong grower, of a semi-climbing habit; is useful as a cattle proof hedge. Seeds or cuttings.

Magnolia grandiflora.—A small tree up to 20 feet in height; slow grower; produces single white flowers in summer; flowers up to one foot across are common. Seeds, but difficult to germinate.

Mandevilla sauveolens.—A strong and hardy climber, with clusters of large white scented flowers in summer. Seeds.

Mangifera indica (The Mango Tree).—The mango is a hardy tree in Mashonaland, but is inclined to be damaged by frosts; fruits readily, and some fairly good fruits are always available during summer. Seeds.

Maurandia antirrhiniflora.—A hardy evergreen climber; strong grower; has small ivy-like leaves, and is usually covered with flowers of different shades of blue, pink or white; it is a very good plant for use on tennis court wiring, but the top of the wire fence should be strengthened with piping to hold the weight. Seeds.

Melia azadarach (Syringa).—A rather large deciduous tree, somewhat like Cedrela; was used extensively at one time for street and garden trees; pretty sweetly scented flowers of a lilac colour, in large panicles; its timber is excellent. Seeds.

Michelia champaca.—A small evergreen tree, producing sweetly scented golden yellow flowers; inclined to die out in a few years, and probably needs a wetter district than Salisbury. Seeds.

Monstera deliciosa.—A large leaved evergreen climbing plant bearing an edible fruit; its leaves are the main attraction, these are about 2 feet long, and over 1 foot wide, and are perforated in an unusual way; is a good plant in a warm situation, and planted against a tree for it to climb; it must have some shade. Offsets.

Morus sp. (Mulberry).—Several species are grown and thrive like weeds. A large fruited variety introduced many years ago by Mr. Justice McIlwaine grows to perfection and is well worth growing for its large fruits. Cuttings.

Muehlenbechia platyclada.—Is a small shrubby herbaceous plant up to 6 feet high, with curious flat branches; small insignificant flowers and red berries; has nothing much to recommend it.

Murraya exotica.—An evergreen shrub of great excellence for hedges, making probably the best hedge in the Colony. It has dark green pinnate leaves, and in early Spring is covered with sweetly scented white flowers; there are only a few hedges to be seen at present, as it is most difficult to obtain good seed, and is very difficult to strike from cuttings. It also makes a fine shrub. Seeds.

Musa ensete.—A banana-like plant, indigenous to the Colony, growing to a height of 12 feet, along the Eastern Border, and always in sheltered places which are inclined to be wet. The plant lives about 12 years, then flowers and dies; the fruits are like bananas, but are filled with hard seeds about three-eighths of an inch in diameter, and from these plants are easily raised. Seeds.

Myrtus communis (Myrtle).—Evergreen shrub, flowering freely in Spring; white. Seeds or cuttings.

Nephrolepis sp. (Sword Ferns).—Beautiful tender ferns, suitable for the verandah and having remarkable variations in the fronds; some are very useful for hanging baskets. Divisions

Nerium oleander (Oleander).—A hardy, strong shrub, growing to 15 feet, and providing a blaze of colour during most of the year; flowers salmon pink, also a white and a dark red variety. The shrub is considered very poisonous. Cuttings.

Nymphæa spp. (Water Lily).—A genus of water plants with beautiful flowers and suitable only in the water garden. The common Rhodesian species has bluish-white flowers, but there are a number of other colours to be had by importation; easily transplanted from rivers to the private pond. Roots.

Osmunda regalis (Royal Fern).—A hardy fern requiring shade and damp conditions; is to be found in cart loads along rivers in the Enterprise District. Roots.

Parkinsonia aculeata (Jerusalem Thorn).—A small thorny tree with light foliage growing to a height of 15-20 feet; flowers yellow, it is a pretty sight when in flower; also makes a good specimen. Seeds.

(*To be continued.*)

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 18. May, 1934.

Flying swarms of the Red Locust (*Nomadacris septemfasciata*) have been reported from most parts of the Colony during the month, but no record of the presence of the Tropical Migratory Locust (*Locusta m. migratorioides*) has been secured.

It should be stated that no swarms of locusts have been reported from the low veld of the Limpopo Valley during May, but whether this indicates their absence or merely imperfect information is uncertain. The impression last year was that the swarms favoured the higher veld and to some extent the more humid portions of the Colony during the dry season.

During May the distribution of the swarms has extended from the Eastern Border to the westernmost district, namely, Wankie, and so includes a considerable range of humidity.

By far the majority of the swarms reported have been described as "large," "very large" or "huge," the biggest of which actual dimensions were given, being stated to extend six (6) miles in width and twenty-five (25) miles in length. Some large swarms have been observed by the Entomological Staff near Salisbury during the last week of the month.

It cannot be said that the movement of the swarms has shown any outstanding tendency in a particular direction during May. There are indications that the swarms at this time tend to drift with the wind to a large extent, and that they may change direction immediately the wind changes. The winds on the whole have been very light during the month, especially during the latter half of the day when the

swarms have most tendency to fly afield. The movements of swarms in the circumstances have appeared to be more or less aimless and have certainly revealed no definite migratory impulse.

Enemies and Diseases.—During the earlier part of the month the locust fungus (*Empusa grylli*) was much in evidence, but the diseased locusts at the end of the month appeared mostly to have died off, and the disease, to a large extent, to have subsided. This was anticipated with the advent of the dry season.

No concentration of birds in any of the swarms has been reported or observed.

Damage to Crops.—Comparatively little damage has been reported, so far as crops are concerned, but plantations of exotic trees have suffered, both from defoliation and breakage, due to the weight of the resting swarms.

Outlook.—The outlook remains as before, namely, the prevalence of winged swarms in the Colony throughout the present dry season.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

MAY, 1934.

Pressure.—The mean pressure for the month was generally below normal.

Temperature.—Temperatures were generally high and the usual May frosts were absent.

Rainfall.—The usual light showers and drizzle were recorded at most stations.

MAY, 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
	Mean.	Normal.	Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	Mean. ½ Max. Min	Mean. Normal.	Mean. Dry Bulb.	Mean. Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	94	50	81.0	56.8	68.9	65.4	65.5	53.3	64	53	...	0.09	0.2	2	...
Beit Bridge	967.4	...	96	45	83.5	54.2	68.8	...	69.5	60.5	59	55	2.4	Nil	0.4	...	1,510
Bindura...	894.4	...	84	46	78.6	51.3	64.9	..	63.4	56.3	65	52	1.3	0.03	0.6	2	3,709
Bulawayo	871.1	872.0	83	45	76.1	51.6	63.8	61.1	61.9	53.9	60	48	3.9	0.12	0.3	2	4,425
Chipinga	895.1	...	81	51	72.9	54.5	63.7	...	64.4	58.2	71	54	3.5	0.74	1.0	3	3,684
Enkeldoorn	859.9	...	81	46	75.4	50.7	63.0	60.9	62.7	54.7	61	49	1.4	Nil	0.3	...	4,787
Fort Victoria	898.3	899.3	85	43	77.1	49.4	63.2	59.9	62.6	55.7	65	50	2.1	0.11	0.3	3	3,570
Gwaai Siding	906.6	...	88	39	83.1	45.3	64.2	...	62.8	54.4	58	48	3.2	Nil	0.0	...	3,280
Gwanda	908.8	...	87	44	78.3	53.4	65.8	...	63.3	56.1	62	51	2.5	0.05	0.3	1	3,228
Gwelo	864.8	...	82	44	75.6	50.4	63.0	60.8	61.7	53.8	60	48	2.8	0.11	0.3	4	4,627
Hartley	889.1	...	85	43	80.7	48.7	64.7	63.4	62.6	55.7	65	50	2.0	0.06	0.3	1	3,878
Inyanga	838.7	...	76	40	70.6	47.4	59.0	...	61.7	53.4	58	47	1.0	0.50	0.6	6	5,513
Marandellas	...	...	...	..	...	...	...	...	...	...	...	...	...	0.18	0.6	1	5,450
Miami	881.3	...	81	48	77.3	52.1	64.7	...	65.0	57.8	65	53	1.3	Nil	0.0	...	4,077
Mount Darwin ...	910.2	...	35	45	81.0	52.2	66.6	..	67.4	60.4	67	56	1.8	Nil	0.6	...	3,178
Mount Nuza	803.6	...	66	42	59.4	46.6	53.0	...	52.5	48.9	80	45	5.0	3.26	...	6	6,666
Mtoko	879.7	...	83	50	77.7	54.2	66.0	...	65.9	58.5	64	53	0.8	0.43	0.4	2	4,140
New Year's Gift...	...	...	89	51	79.8	54.3	67.0	...	63.9	57.9	70	54	...	0.25	0.5	3	2,690
Nuanetsi	965.4	...	94	46	84.0	52.1	68.0	...	68.9	60.1	59	54	2.5	Nil	0.3	...	1,650
Plumtree	866.6	...	82	44	75.5	54.1	64.8	..	62.8	53.4	54	45	2.8	0.66	0.7	2	4,549
Que Que	884.8	...	82	46	79.3	51.5	65.4	...	64.5	55.6	57	48	2.1	0.12	0.2	1	3,998
Rusape...	864.7	...	82	41	73.8	46.8	60.3	...	60.5	54.6	69	50	1.3	0.40	0.4	1	4,630
Salisbury	857.2	857.8	81	45	75.9	49.9	62.9	61.0	63.6	55.6	60	49	1.5	0.09	0.5	3	4,885
Shabani	910.5	...	88	50	78.5	55.8	67.2	..	63.5	55.9	63	50	4.2	0.10	0.6	1	3,192
Sinoia	890.5	...	84	41	80.7	46.4	63.5	...	65.2	57.3	61	51	0.8	0.22	0.4	2	3,793
Sipililo	887.7	...	83	45	78.0	53.1	65.5	..	65.9	57.7	60	52	1.4	Nil	0.5	...	3,875
Umtali...	895.8	896.5	82	47	75.2	53.6	64.4	62.6	63.5	59.0	77	56	3.5	0.24	0.5	3	3,670
Wankie	929.6	...	91	55	86.5	60.3	73.4	...	67.7	56.6	50	49	2.3	Nil	0.1	...	2,566

Southern Rhodesia Veterinary Report.

APRIL, 1934.

AFRICAN COAST FEVER.

No cases have occurred.

TRYPANOSOMIASIS.

Seven cases in the Melsetter district.

ANTHRAX.

One case occurred in the old infected area in Salisbury.

MALLEIN TEST.

Eight horses were tested upon entry with negative results.

TUBERCULIN TEST.

Four bulls were tested on importation; no reaction.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Bulls 12, Horses 6, Sheep 535.

EXPORTATIONS.

Cattle to Durban for export overseas:—2,966.

The the United Kingdom *via* Union Ports in Cold Storage:—Beef fore-quarters, 5,681; hind-quarters, 6,056; boned-quarters, 2,391; veal, 44 carcases; boned veal, 29 carcases; skirts, 3,928 lbs.; livers, 20,296 lbs.; tongues, 12,388 lbs.; hearts, 7,917 lbs.; shanks, 8,397 lbs.; tails, 6,588 lbs.; kidneys, 459 lbs.

Meat products from Liebig's Factory:—Beef Powder, 34,552 lbs.; beef fat, 11,205 lbs.; tallow, 78,489 lbs.; meat extract, 39,959 lbs.; bone beal, 10,000 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Farming Calendar.

JULY.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry our repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay

and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inches over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

AUGUST.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal*. Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and,

if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farmyard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillers. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1¼ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage,, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses. etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas; as most poultry keepers know. are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible. and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

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No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwtring, Agriculturist.
6o. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
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TOBACCO.

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DAIRYING.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Foot and Mouth Disease.—It is most unfortunate that hardly had the Colony again obtained access to its normal outside markets, following the last outbreak of foot and mouth disease, and organised a regular export trade in chilled beef to the United Kingdom, than these operations should again be suspended—we hope only temporarily—by a renewed outbreak of foot and mouth disease on the Nuanetsi Ranch.

This disease was diagnosed on the Mkuni Section, but was later found to have extended to certain adjoining sections, while a mob of cattle composed of 150 bullocks and 50 cows moved towards West Nicholson before the outbreak was reported, and quarantined at the junction of the Selous road and the Msano River, was subsequently found to be infected.

At the time of writing these are the only two areas known to be affected.

The troop of oxen and cows referred to were found to have mixed at drinking places with some 400 head of native cattle, and on the advice of the Chief Veterinary Surgeon the Government decided to adopt the slaughter policy in respect of this approximate 600 head of animals.

A police cordon has been established along the south bank of the Lundi River, along the Nuanetsi River and along that section of the main Victoria-Beit Bridge road which connects between these two rivers. A further and supplementary cordon has been established along the east bank of the Umzingwani River.

As an added precaution all long distance movements of cattle, virtually throughout the whole Colony, have been suspended, as was the movement of cattle for sale by public auction until the end of last month.

A virus station has been established at the headquarters of the Nuanetsi Ranch by the Director of Veterinary Research, and the inoculation of all cattle involved in the outbreak is actively proceeding. A cattle free zone has been formed around the infected area.

It is hoped and believed that the drastic and rapid action adopted will prove effective in preventing further spread of the disease and that export of the animal and vegetable products of the Colony, excepting probably only live cattle, will shortly be renewed.

Official Notice.—Grass Fires.—The Department of Agriculture and Lands desires again this year to invite the attention of all members of the public resident in Southern Rhodesia or travelling through the Colony to the urgent need for caution in respect of veld fires. In certain cases where spraying operations against locusts have been carried out or where animal disease is prevalent, burning of the grass will be necessary, but the extensive uncontrolled veld fires which so frequently occur inflict most severe hardship on livestock and accentuate the evils of soil erosion.

All owners and occupiers of land, Government officials and members of the travelling public are therefore earnestly asked to use their utmost efforts to guard against inadvertent veld fires, and whenever possible to assist in suppressing any accidental grass fires that may occur.

Attention is invited to the provisions of the "Herbage Preservation Ordinance, 1913" as amended.

"Mother Earth."—The following is an extract from the editorial column of the June issue of *The Fertiliser*: "The National Fertiliser Association of the United States is holding its annual convention during the present month and the occasion seems peculiarly appropriate for reproducing the following beautiful paragraph from an address delivered to the 1930 convention at Colorado Springs, by Colonel Clarence Ousley, war-time Assistant Secretary of the United States Department of Agriculture:—

> I always contemplate the earth with reverence. I like the phrase ' Mother Earth '—the source of all our sustenance, the storehouse of all our supplies, our raiment, our shelter, the pathway of our feet, the final resting place of our worn-out bodies. And of all its elements and attributes the soil seems to me to be the most appealing and vital, and I cannot but regard its depletion as vandalism and sacrilege. The good God gave us but one soil, and he gave it for the use of his children to the end of time. We are but his trustees in the occupancy and preservation of the estate of all posterity. If we despoil it, if we fail to maintain it, if we leave it less fruitful than we receive it, we are unfaithful trustees, and I feel that in the sight of God we are as culpable as if we robbed the estate of orphan children of whom we were made guardians by decree of court."

Treatment of Tobacco Seed.—The Chemical Branch of the Department is again prepared to undertake the cleaning and disinfecting of tobacco seed on behalf of growers. The charge will be 6d. per ounce of cleaned seed plus 3d. for the new

linen bag in which the seed is returned. Seed for treatment should be addressed to the Chief Chemist, and as the lots received are treated in strict rotation no time should be lost in forwarding the requirements for next season.

Tobacco Research in Canada.—Tobacco Research is being conducted at four Experiment Stations and one sub-station in the Dominion of Canada. The scientific work is arranged from the Central Experimental Farm, Ottawa, and the Experiment Stations themselves are conducted by one or at most two resident officers. The most important station is probably that at Harrow, Ontario, with its sub-station at Delhi. The programme of work on the Harrow station consisted of cultural experiments, variety tests, fertiliser tests, and rotations. The following conclusions were drawn from the experimental work of last season:—

(*a*) Sterilising the seed-beds by steam gave the most satisfactory results.

(*b*) Experiments with different rates of seeding showed that thin seeding was preferable to thick seeding. Beds seeded one ounce to 1,200 or 1,400 square feet gave more early plants of transplantable size than beds sown at a thicker rate. Thin seeding cut down the danger of damping-off and also gave tougher, sturdier plants at transplanting time. The seed used for the purpose germinated more than 80 per cent.

Experiments showed that plots set to plants well hardened-off before transplanting required less replanting than plots set to tender plants. This was particularly true of the heavier soils where weather conditions continued very dry and hot.

In experiments dealing with the cost of production, the cost of producing plants on the Harrow Station was 96 cents per thousand.

(*c*) Plots ploughed medium early, well worked down and left in a firm condition for transplanting resulted in a better stand of plants than if the land were ploughed late and left in an open condition. Early and thorough preparation of the soil also helped to destroy the weeds.

(*d*) Applications of poisoned bran bait were applied two consecutive evenings previous to transplanting. Practically no damage resulted from cutworm infestation.

(*e*) Following up with a one-horse cultivator as early as possible after transplanting proved beneficial in getting the young plants away to a good start. Deep cultivation was practised during the early part of the growing season shading off to a narrower and shallower cultivation as the plants advanced towards the topping stage. Cultivation ceased when the tobacco was ready to top. A very steady normal growth was noted under this practice.

(*f*) Fertiliser was applied broadcast and also in the row. More replanting was necessary when the fertiliser was applied in the row due to fertiliser-burn. No significant difference was noted between the two methods on maturity or on the yield or quality of the cured leaf. Over a period of years, however, the difference was slightly in favour of drilling in the rows.

If fertiliser is applied in the row, a period of 10 days should elapse before transplanting. This cuts down the danger of the fertiliser burning the young seedlings, especially when highly concentrated mixtures are used.

Experimental Work at Delhi.—A very interesting programme of experimental work on flue-cured tobacco has been outlined for the Delhi Sub-station. In addition to the fertiliser experiments and variety tests that were initiated on the Sub-station during 1933, several series of plots are being added, dealing with various crop effects, short rotations, and nitrogen-potash fertiliser ratios. All of these new series will be conducted on quadruplicate plots, one-fortieth acre in size, and radomized in order that they may be studied statistically. The outstanding flue-cured varieties will also be tested on the principal soil types in the district. Various cultural practices, with special reference to distance of planting, suckering, and priming flue-cured tobacco, will be thoroughly studied on the Station. Some studies on the mosaic disease of tobacco will also be conducted in co-operation with the Dominion Labora-

tory of Plant Pathology, at St. Catharines. In addition, a number of tobacco hybrids produced at the Tobacco Division, Ottawa, will be grown with a view to determining their value for commercial purposes and to afford an opportunity for selection work.

In all some 650 plots will be required for this work. It is anticipated that the entire programme will be under way this summer. The experiments as designed primarily to furnish practical information on flue-cured tobacco, to be made available to tobacco growers through the continued co-operation of the staff at this station with the Provincials officials.

Lectures on Agriculture.—Twenty-two years ago a series of lectures on Agriculture was given by officers of the Department, and it was intended that a similar programme should be arranged each year. The scheme proved to be very popular, and for the first course, which was given at the Experimental Station, Salisbury, during August, 1912, twenty-five farmers attended the whole series and no less than seventy attended part of the course. The subjects dealt with covered a wide range: cattle, dairy, sheep, poultry, crops, fertiliser, hay and hay making, forestry and irrigation were all dealt with in a series of approximately sixty lectures.

A second course on similar lines was given in August, 1913, but with the outbreak of the Great War this plan was dropped. It has been suggested recently that an attempt should be made to revive it and endeavour to arrange a course specially adapted to farming conditions in the Colony. It is urged that this would be of great assistance to young men who wished to take up farming and also to established farmers who desire a kind of "refresher" course. The completion of the new chemistry building makes the possibility of such action feasible as the library room would provide a suitable lecture room for at least twenty or thirty students. If there is any real demand for such a course at the present time the Department is quite prepared to meet it, and the views of readers on this suggestion will be welcomed.

Some Facts about Tung Oil.

By R. H. Finlay, B.A., Dip. For. (Oxon.),
District Forest Officer.

In view of the fact that many enquiries continue to be received by the Forestry Division as to the growing of Tung Oil, it is thought that a short article summarising the available information on the subject will prove of value.

The Tung Oil Tree, *Aleurites Fordii*, is indigenous to China. Up to the present day China alone has exported Tung Oil, which has been found to be valuable as an ingredient of paints and varnishes and superior to other oils owing to its rapid drying qualities.

Outside China seed was first raised in Florida from samples imported by the United States Agricultural Department in 1905, and these trees are alive to-day. In fact, it was largely through data collected from these and subsequent specimen trees and groves that the American Tung Oil Corporation was formed by the National Paint, Varnish and Lacquer Association Inc., with the object of laying down large scale experiments.

Some idea of the interest displayed by Americans in this crop may be gained from the statement that the minimum estimated acreage in the United States was 28,750 acres in April, 1932, this area having apparently been planted in a period of approximately ten years.

At the same time and actuated by a fear that in any future crisis supplies might become difficult to obtain, as they did during the War, the Imperial Institute brought up the question of its cultivation in the Empire, but it was not until 1928 that the Research Association of the British Paint, Colour and Varnish Manufacturers made a determined effort to introduce it in suitable parts of the Empire. With the aid of the authorities at Kew, seeds were distributed throughout the Empire for trial planting.

As mentioned above the chief use of Tung Oil is as an ingredient in paints and varnishes, and more especially for those used in aeroplane manufacture.

It is now being employed in the manufacture of insulating compounds, brake linings, linoleum, waterproof fabrics, as a binder for synthetic boards, synthetic resin, battery jar compounds, aeroplane tubing, filters and primers.

The tree, though indigenous to China, is not cultivated there and fruits are simply collected from isolated trees on stony hillsides and taken thence to mills which express the seed in a crude and wasteful fashion. Owing to the unsettled state of China, and the large local demand, it is not anticipated that there will be any material increase in exports from that source.

Imports into the United States have fluctuated considerably in the last few years, but in the three years prior to the advent of the slump in 1931 they averaged 117,000,000 lbs. of oil valued at 13,263,000 dollars (a gallon of oil weighs 8 lbs.).

Imports into the United Kingdom for the years 1928 and 1929 averaged 3,915 long tons valued at £226,732.

Imports of both countries show a tendency to increase fairly rapidly.

Before going into the question of yields, it must be pointed out that the following figures are only estimated on American conditions in the Southern States, such as Florida. Nevertheless, from a careful perusal of the facts so far collected, it appears that they have been calculated on a conservative basis.

It is not possible to base estimates on Chinese experience, partly owing to the fact that yields have in most cases only been estimated by travellers, but chiefly owing to the fact that the cultivation of *Aleurites Fordii* is not undertaken in plantation form.

A 220 acre grove belonging to the American Tung Oil Corporation planted in 1924-25 yielded 75,000 lbs. of dried fruit in 1931. One plot of 5 acres in this grove yielded 1,529 lbs. per acre in 1929.

Ten 19-year-old trees on the other hand, during the period 1927-29 and 1931 averaged from 21-480 lbs. of fruit per tree, thus illustrating the wide variations to be experienced. A few individual trees on the estimated maximum producing age have given 100 lbs. of fruit each.

It is stated, however, that from the experience gained a yield of 50 gallons of oil or 2,500 lbs. of fruit per acre at 10 years will be considered satisfactory, and it is noteworthy that a private company's grove of 30 acres yielded 1,300 lbs. per acre at 6 years.

In America the fruit is decorticated and the hard pellicle or seed covering removed by a machine which deals with approximately 3,000 lbs. of dry fruit per hour.

The decorticated seed is then treated in an Anderson Expeller at a rate of approximately 500 lbs. of meal per hour. It will be obvious then that unless large areas are planted the erection of plant for treating the seed would be uneconomical, more especially as it is stated that the cost of an expeller and equipment alone costs 5,000 dollars or about £1,000.

It is suggested by the Imperial Institute, that in the early stages it might be sufficient to decorticate the fruit only, and ship the seeds in bags for treatment in the United Kingdom. The hulls could then be returned to the plantation, where they would form a valuable addition to the humus content of the soil.

Sufficient has now been said of the possibilities of this crop, and it remains to state that the American production is expected to supply only the increasing local demand and not to oust the existing imports from China. Calculating on the above figures, the U.S.A. to be self-supporting, would require plantations to the extent of 292,500 acres.

Types of Tree.—There are two species of Aleurites producing valuable oil, *viz.*, *Aleurites Fordii* and *Aleurites montana*. The latter, however, has been given little attention, as it is thought to be more suited to tropical climates with a high hot-weather rainfall.

Of the *Aleurites Fordii* there are at least two varieties, namely, single fruited and multiple cluster, so named because in the first instance fruits are borne singly and in the second instance in clusters.

Accounts vary as to which yields most fruit, as the single fruited type bears larger fruit, but the general opinion appears to be that the cluster variety is the better.

Description.—The tree which attains a height of approximately 30 feet is of spreading habit, its crown being 15-30 feet in diameter. Pruning is often adopted in order to form a good crown.

The foliage is dense, the leaves being large and heart-shaped. The flowers, which are white with pink centres, are of two sexes and appear before the leaves. In America they are very sensitive to frost, but appearing as they do in Rhodesia about October, are more likely to suffer from winds than from this cause.

Fruits ripen and fall about April, when they gradually dry out and split up into 3 to 5 segments, each containing one seed.

These seeds, which are enclosed in a woody pellicle, contain a fleshy white kernel which contains the oil. There are about 120 seeds to the pound and the seed is approximately 60 per cent. of the whole fruit, so that for one pound of fruit 70 seeds may be expected.

Germination.—The viability of the seed deteriorates rapidly, and it has been found that this deterioration is even more rapid if hulls are removed. For this reason seed is sold in the form of whole fruits.

It is impossible to give any definite figure for germination, as this depends on the age of the seed, climatic conditions and other factors. For seed that arrives fresh in this country, however, it is considered that a 50-60 per cent. germination is reasonable, and there are indications that when seed is available from locally grown trees 90 per cent. germination may be expected.

Nursery Methods.—The fruits should be soaked in water for 24 hours and the hulls removed, leaving the seed only, with its brown or black covering.

The seeds are sown in beds and covered with $\frac{1}{4}$-$\frac{1}{2}$ inch of soil and given ordinary nursery treatment.

Seed may be expected to start germinating in 4-6 weeks and to continue doing so for a further month. Plants should be pricked out into deep tins when they reach a suitable size, *i.e.*, 2-3 inches, or when suitable weather conditions prevail.

If the area is liable to frost due precautions should be taken to protect the young seedlings.

Preparation of Land and Cultivation.—The usual preparation of land as advocated for forest trees should be carried out, but it is necessary, in view of the wide spacing of the trees, to cultivate extensively.

It must be borne in mind that this crop is a specialised one, and akin to fruit growing and rubber production. In America it is recommended that for the first year cultivation should be carried out for 6 feet on either side of the tree rows and a cover crop grown between. Subsequently the trees are mulched and cover crops again grown until the trees have grown sufficiently to shade the ground. In America velvet beans and cowpeas are recommended among other crops of this nature.

Fertilising of Tung Oil trees is being carried out in various groves in the United States, but there appears to be considerable doubt as to its economic value, and growers are agreed that it may be some years before its value can be proved.

Similarly the espacement is still under discussion, and while it is agreed that a wide aspacement of 25-30 feet will be necessary when trees are in full bearing, some growers suggest that it is better to plant at 15 feet x 15 feet and remove half the trees later in order to save cultivation costs.

Pruning.—It is sometimes advisable to prune the young trees when set out in the land, in order to maintain the balance between root and branch area.

Pruning of the young trees is not recommended after planting until 3 to 4 years, when the character of the tree is developed, and should then be confined to dead wood, interfering branches and adventitious shoots. The object is to grow a tree with a large spreading crown.

Fruiting.—Tung trees may produce fruit from the third year onwards, but some growers in America try to prevent the setting and formation of fruit till at least the fourth year, claiming that this encourages the formation of a better tree in the young stages. So far, experience in Rhodesia has been that trees seldom fruit at such an early stage. One of the trees which has been under observation is now 7-8 years old. Fruiting commenced in 1931. A small crop of 4 lbs. was collected in 1932 and the approximate dry weight of the 1933 crop was 22 lbs.

In the past season, however, seed failed to set, possibly owing to a severe hurricane which occurred at the time of flowering.

Soil.—Only the best soil should be chosen. This should be deep and well-drained. Vlei land is unsuitable. Deep sandy loams, or heavy red soils appears to be suitable.

Rhodesian experience is confined chiefly to the heavy red soils, though instances of trees said to be doing well on sand veld are known.

Qualities of Rhodesian Oil.—A sample of fruits sent to the Imperial Institute for test was reported to be similar to commercial oil and of good colour and acid content.

Diseases to which Tung Oil is Subject.—No serious diseases or pests have attacked Tung Oil in America up to the present. They have been attacked by root-knot and scales, and in addition trees have died owing to unsuitable soils such as limestone. The most serious disease has been that known as "bronzing," but a cure appears to have been found for this in the application of zinc salts to the soil.

By-Products.—After extraction of the oil from the seed there is left a considerable amount of meal, which at one time was thought might possibly be suitable for stock-feeding purposes in the form of cake.

Experiments with rats, cattle and pigs have recently been carried out by investigators at the Rowett Institute, which prove that the cake has an irritant effect on the intestines which results in loss of weight. Animals, moreover, will not eat the residue of their own accord.

As has already been stated, the husks which contain such quantities of phosphoric acid and other plant foods are useful as a mild fertiliser. They can also be used with great advantage as a mulch for the young trees, and in this connection it is considered possible that they may harbour beneficial bacteria which greatly encourages growth.

Conclusion.—Though many of the indications are encouraging, it is considered that it will be some years before it will be possible to recommend this crop for general cultivation. Rhodesian experience has so far been based on a few individual garden trees.

The foregoing figures are therefore presented, not with a view to boosting a crop which is unknown to Rhodesia, but to give those farmers considering its possibilities some of the main facts as presented in available publications.

*An Important Bulletin on Witchweed.

In the treatise under review are published the results of the admirable research carried out by Dr. Saunders at Potchefstroom over a number of years, and they are of the greatest interest and importance to all those whose living is concerned with the growing of maize. Though the technical form of their presentation here makes them somewhat indigestible to the layman, nevertheless a perusal of this bulletin would help to give a clearer idea of the life history of the parasite and the possible means of its control. A great deal of new material is presented for the first time, and this serves to illuminate the question of the methods of control to be employed in the field.

Dr. Saunders has shown that the partially resistant strains of Kaflir Corn examined owe their resistance to the parasite, not to the fact that their roots do not exude the substance which stimulates the germination of the seeds of the parasite, but to the fact that the sucking organ by which the witchweed attaches itself to the host meets with various types of obstruction, which prevent the parasite from "establishing a successful relationship with the host."

This has led Dr. Saunders to suggest the use of such partially immune strains of Kaffir Corn as trap-crops to germinate the parasites and subsequently cause their death owing to their inability to thrive on such resistant hosts. In this way if a suitable resistant strain be grown for a time on infested land the latter would be freed from infestation by the parasite, whilst at the same time producing a marketable crop of grain.

Owing to the negligible local market for Kaffir Corn in this Colony, however, it is not thought that this method will have a wide field of usefulness here, unless the price of Kaffir

*Studies in Phaneorganic Parasitism, with particular reference to striga lutea, Lour. (Witchweed), by A. R. Saunders, M.Sc., Agric. (Wis., U.S.A.) Science. Bulletin No. 128, Department of Agriculture, Union of South Africa.

Corn in the neighbouring territories is sufficiently high to warrant the export of the grain. Apart from this consideration the Kaffir Corns have not been found to thrive *as grain crops* in the maize belt here, and their sowing for this purpose could not be recommended without reservations, owing to their susceptibility to various pests attacking the stems and ears, and also to the fact that only moderate yields of grain have been obtained as a rule in the past.

For this Colony, where the severity of the infestation of the soil warrants such methods, it is thought that the substitution of a suitable susceptible trap-crop, such as Amber Cane, for the green manure crop in the rotation is still the most effective, simple and economical method of control of the pest, and this method has become well established amongst the farmers of the maize belt, owing to the excellent results obtained.

There is every reason to think, however, that when Dr. Saunders' breeding and selection of the most suitable resistant strain of Kaffir Corn, on which he is now engaged, is complete that this system of control will be extremely valuable in the Union of South Africa, and in other parts of the Empire, such as India, where large quantities of Kaffir Corn are grown.

A list of some forty-six species of grasses and grass crops, which are known hosts of witchweed is given, and amongst them the following may be mentioned as having particular interest for farmers in this Colony:—Oats, wheat, barley, rye, couch grass, rhodes grass, cocksfoot, ten species of panicum, including the buffel grasses, native paspalum and the two commonly grown exotic species, and kikuyu grass.

Dr. Saunders has shown that the presence of excess of moisture hinders the germination of witchweed seed, and this together, possibly, with the consequent low soil temperatures, probably explains the reduction in the amount of the parasite seen above the ground in this Colony, which has been noted during very wet seasons.

Owing to the chemical instability of the substance contained in the secretion of the roots of hosts which stimulates

the germination of the seed of the parasite, the author was unable to definitely identify it, and he holds out no hope, for the same reason, that it may ever be possible to synthethise the substance and use it as a means of control. In this connection it is of great interest to note that recent research work done in India* has apparently established the fact that a secretion by the roots of maize plants stimulates the nitrogen-fixing organisms in soil to fix more nitrogen from the air under certain specified conditions. It would be of great interest to know if the two substances are identical, and whether the two reactions have any connection.

Dr. Saunder has proved that the liberation of the excretion by the roots of the maize plant commences very soon after the germination of the maize seed, as soon, in fact, as the root hairs are formed on the radicle.

There is much more of tne greatest interest in this bulletin, but it has only been possible here to refer to a few points. In conclusion, it may be said that we are deeply indebted to Dr. Saunders for this most important contribution to our knowledge of the most formidable pest of the maize plant, which is doing enormous damage annually in this Colony and elsewhere in the Empire.

*N. D. Vyas, L.Ag., in Indian Journal of Agric. Sci., Feb., 1934.

PIGS.

REPORT FROM THE OFFICE OF THE HIGH COMMISSIONER, LONDON.

History.—Fresh and frozen pork came into the United Kingdom from certain European countries until June, 1926, when, on the grounds of precautions against foot and mouth disease, a complete embargo was placed on these imports.

Bacon was not affected by this embargo, but it is by arrangements concluded at the Ottawa Conference. In 1929 the Imperial Economic Committee issued a Report (No. 12) on "Pigs and Pig Products," in which the following observations occur:—

> "The scope of the market is so large as to be capable of becoming of great profit to Empire producers." . . . . "We urge on producers the need for greater organisation" . . . . "those who have trade connections and remain persistently in the trade will, on the average, benefit the most."

Sources of Supply.—New Zealand was the first to act upon these lines—and England the latest. Canada, in 1929, was the principal Empire exporter of pig products, but has since steadily reduced her exports to England. There are two reasons for this: an increase of consumption in Canada, and, particularly with regard to bacon, her distance from the market which prevents Canadian producers from forwarding or withholding supplies in accordance with the abrupt fluctuations of the market. It is worthy of note, however, that Canada is now (November, 1933) again entering the picture (*vide* attached Press Bulletin).

Australia is in the market, but spasmodically, and in a comparatively small way. A number of Australian producers show indications of dropping out because they cannot make the business pay. The Australian quality is now up to that of New Zealand.

Argentina supplies the United Kingdom with a considerable number of porkers but, as far, they are of inferior quality.

The position of England is peculiar and now rather obscure. English pigs are of the highest quality; the determining factor is the price of pig-food. The Government has lately been urging increased local production of bacon-pigs, with the promise of greater restrictions upon foreign quotas. The response from the farmers has been astonishingly and embarrassingly successful. At a price depending on the current price of food, the United Kingdom farmers have recently contracted to supply the curers with 620,000 carcasses during a period of four months. This far exceeds expectations and has disorganised the market. It may have important results to Empire and Danish producers, and even react upon the pork market.

The Marketing Season in United Kingdom.—The quantity depends on the thermometer. The maximum supply is required in midwinter and the minimum in June, but the old seasonal limits of September to April (exclusive) are fading out. There is an increasing demand for pork during the summer months. It can, however, be said that a cold summer means an increased consumption and a mild winter a decrease. During the winter the small pigs sell best and in summer there is some demand for larger animals (100/120) for cutting up.

New Zealand.—Subsidy and Levies.—The methods of New Zealand are of most interest to Southern Rhodesia. In 1928 the New Zealand Government granted an export subsidy of ½d. a pound, in the form of a refund of freight, on carcasses between 60/180 lbs. dead weight. The industry soon got on its own feet and in 1931 this subsidy was withdrawn, having been paid for three seasons only.

A levy was imposed (in support of the Meat Producers' Board), which from November, 1923, was 1d. a carcass, but in January, 1931, was reduced to ¾d. owing to the accumulation of sufficient funds.

Quantities Imported to United Kingdom.

Porkers Imported to United Kingdom from New Zealand.

Season.	Cwts.	Value.
1931	98,705	£286,194
1932	103,770	249,747
1933	195,270	437,310

A considerable increase is again expected during the present season.

NOTE.—The "Season" ends on 30th September. Pigs killed in March, or later, are accumulated in cold storage in New Zealand till the English cold season demand commences in earnest; the Meat Producers' Board co-ordinating available space on ships so as to fit in with the slack periods in lamb, beef and veal export.

The pig industry in conjunction with dairying; the pigs being fed on separated milk and meat-meal, barley, maize, etc., according to circumstances.

General Sizes needed in U.K. Market.—The United Kingdom market calls for small lean pigs.

The best price is given for pork carcasses between 60/100 lbs. dead weight. New Zealand grades and sub-grades are as follows:—

Highest price,		60/80 lbs.	
next	,,	81/90 lbs.	This is a recent sub-division and is of considerable convenience to retailers
next	,,	91/100 lbs.	
Lowest	,,	101/120 lbs.	

Baconers should be 120/160 lb. up to 180 lbs.

Large pigs fetch low prices.

Prices.—Prices have ranged as follows:—*Porkers*, per pound:—

1929—6d. to 8d.
1930—8d. to 10d. (Peak year. Local shortage).
1931—4½d. to 6½d. (Australia enter market).
1932—4½d. to 6½d.
To-day—60/80 lbs., 6¾d.
November, 1933—80/100 lbs., 6d.; 100/120 lbs., 5⅝d.

Baconers per pound:—

1929 to 1930—Average about 7d.
1931—4½d. to 6d. (Heavy supplies from Denmark).
1932—4d. to 5d.
1933—Nominally 5d., but present position uncertain for reasons suggested below.

Packing.—Mutton-cloth, under hessian.

Ports in United Kingdom.—London is the best market for porkers, Glasgow for scalded baconers and Avonmouth for singed baconers.

Charges.—Landing, weighing, cold storage and delivery charges come to about $\frac{1}{4}$d. a lb. a month. Twenty-eight days is the minimum period charge for cold storage, *i.e.*, 2 days or 27 days count as 28 days. Additional period cold storage charge about $\frac{1}{8}$d. a month.

London is the chief port, but a few cargoes go to Liverpool. The charges are the same.

The inclusive charge for landing, cold storage, delivery to market and selling commission, works out at about $12\frac{1}{2}$%.

A pro-forma invoice is attached.

Advances.—Advances against shipping documents 80%, when necessary.

Costs of Importing.—New Zealand exports regular quantities at regular intervals, and always of good quality.

A few years ago her costs for killing, freezing, transport, landing, storage and marketing were $2\frac{1}{4}$d. lb.

Owing to large supplies and good organisation, it is now nominally 2d. per lb. which, taking into consideration exchange differences, works out at considerably less to shipper. For instance, 6d. paid per pound in England, reaches New Zealand as $7\frac{1}{2}$d.

The Union of South Africa's figures, based on small and irregular consignments, are reported to work out at about $2\frac{3}{4}$d. or a little more.

The Union-Castle Company's charges, Cape Town to Southampton, are quoted at $\frac{3}{4}$d. per lb., but all arrangements for space would have to be made through the South African Perishable Products Control Board.

Feeding for United Kingdom Market.—**The English market demands lean pigs to produce which a hard grain must be included in the rations. The pre-eminence of the United States of America as a lard producer is based on maize.**

Breed of Pigs Required.—Experts differ upon the " best " breed, but there seems general agreement that, whatever sow is used, the Large White Yorkshire is a very suitable boar.

Sows of the black varieties are recommended in tropical countries and the cross, as above indicated, is suitable for the English market.

Denmark.—Although the supplies of home-killed pigs offering rules the market prices, the position of Denmark is exceedingly important to Empire bacon and bacon-pig exporters as the following figures show:

Bacon Imported to United Kingdom (in cwts.)

	Denmark.	All sources (including Denmark).
1930	6,117,866	9,191,182
1931	7,339,195	11,133,676
1932	7,672,030	11,405,932

1933 (figures not available, but still very large from Denmark).

The success of Denmark is due to rigid standardisation of weight, type, quality and conformation.

Danish pigs are fed on separated milk and barley.

The producers work on co-operative lines and the farmers own, or at least have an interest in, the bacon factories.

Owing to the great response from English farmers to recent Government interest in the marketing of Home-killed pigs, increased restrictions (until lately by "voluntary" quota) are being imposed against Danish and other foreign bacon imports, and these may react upon the importation of Empire porkers.

Irish Free State.—The Irish Free State was once a big factor in the United Kingdom pig and pig-product market. At present, owing to political differences, there is a duty on Irish pork and bacon entering England; there is also a quota for Irish bacon (to counteract the export subsidy paid to Irish producers). But it is possible that she may, at some future date, re-enter on Empire (preferential) terms.

Market Fluctuations.—Fluctuations are much more rapid and abrupt in the bacon than the pork market.

Danish bacon is sold on commission for whatever it will fetch, but Denmark is so near, and its organisation is so efficient, that a pig may be eating its own breakfast in Denmark one morning and form the breakfast-rasher of a man in the English provinces 10 days later.

Compare this with the position of Canada, the nearest overseas Empire competitor. While a consignment is off-loading in the London Docks, another is at sea, another loading in Toronto, another freezing in the works and another collecting for slaughter and curing in the country. These consignments are such a week apart and all must go forward however low the market may have fallen.

Summary.—Southern Rhodesia has no opening in the United Kingdom for bacon. She has, perhaps, a small chance with baconers shipped frozen for curing in England. Her best opportunity lies in porkers, which is an expanding market and less given to fluctuation than baconers.

The French Tobacco Monopoly.

By D. H. Tobilcock, Beit Trust Fellow.

The French Tobacco Monopoly was first established in 1674 by Colbert, the French Minister, who was a vigorous practical exponent of mercantilism, for the purpose of raising revenue to swell his depleted resources at a time of great financial difficulty. The method adopted was simple: the rights of manufacture and sale of tobacco were farmed out for a period of years to a single individual for the consideration of about 600,000 francs. This system remained in vogue until 1791, when the National Assembly introduced a new policy as a result of the change in general conditions consequent on the French Revolution and the permeation of the new economic doctrines, engendered by the Physiocrats, throughout France. It was decreed that every person was free to cultivate, manufacture and sell tobacco; that the importation of foreign manufactured tobacco would continue to be prohibited and that foreign leaf tobacco could be imported subject only to a small negligible import duty.

Under the influence of these measures the State revenue from tobacco almost disappeared, and in order to make up this budgetary loss, a system for the licensing of manufacturers and retail dealers and for regulating planting by means of State surveillance had perforce to be introduced, whereby the industry re-established itself as a profitable source of revenue.

The year 1810 found the State entering into the industrial sphere when Napoleon re-established the monopoly, this time under the management of a department responsible to the Minister of Finances. An elaborate system was introduced to control the three divisions of the industry, *viz.*, production, manufacture and marketing. It was realised from the beginning that full control of the home production was essential to the success of the scheme. As a sort of *quid pro quo*, each

farmer was guaranteed a market for his product at a price to be determined upon each year by a commission comprised of both technical and financial experts.

In order to ensure that the bulk of these purchases was consumed, various regulations were passed setting out the percentages of each grade of tobacco to be used in the manufacture of the various brands of cigarettes, cigars, etc. Knowing that the home production would not be sufficient to supply the total requirements, the deficiency was made up by importation from foreign countries. This fact has been turned to account from time to time as a means of commercial bargaining with other nations, as witness the 1927 agreement with Hungary, whereby the latter obtained a share of this trade in return for certain reciprocal concessions.

The net-product of this monopoly was included in the annual State Budget up to 1926, when a most important change took place. For several years the financial danger of a circulation of nearly 50 milliard francs of very short-term "Bons de la défense nationale" had been harrassing an already overwrought Government, and in an attempt to lay this bogey, the "Caisse autonome d'amortissement," or self-governing sinking fund, was established, whose function it was to manage this debt as well as the amortisation of the public debt for long-term borrowings.

Its resources were two-fold—one, the net product of the tobacco monopoly, which was to be used to pay the interest and redemption on the "Bons" and, two, various general resources which were to be set aside for the repayment of the public debt.

The value of the net product for the four years 1928-31 is shown in the following table:—

Net Product 1928-31.

Receipts and Expenses.	1928. £1000	1929. £1000	1930. £1000	1931. £1000
Receipts	32,116	35,595	36,590	37,170
Expenses...	6,626	7,245	9,620	9.130
Net Product... ...	25,490	28,350	26,970	28,040

Note.—Figures converted at par.

In the case of an ordinary monopoly of supply, the aim usually is to produce as large a *net* revenue as possible without necessarily varying the quality and price of the product considerably. In France, however, the pressure of financial necessity, no doubt, influences both these factors. To what extent the inferior quality factor, judged by British and American standards, is influenced by the financial aspect, it is impossible to say, but after the fashion of Gresham's Law, it is highly probable that no amount of blending of superior imported tobaccos with the locally produced article could improve the quality. The reverse is also true, and consequently the obvious policy is to purchase supplies from abroad in the cheapest market.

Turning from the financial to the commercial aspect in an endeavour to investigate the types of tobacco imported into France for blending with the local product, it is necessary first of all to study the quantity of tobacco purchased by the monopoly. The following table shows the quantity of tobacco leaf actually purchased by the monopoly commission for the years 1927-29:—

Actual Purchases of Tobacco Leaf by the Monopoly
1927-1929.

Source of Tobacco.	1929. 1000 lbs.	1928. 1000 lbs.	1927. 1000 lbs.
A.—Produced in France—			
(*a*) under the monopoly proper	33,240	49,970	44,900
(*b*) the Alsace-Lorraine Service	18,000	14,000	13,000
Total	51,240	63,970	57,900
B.—Produced in the Colonies—			
(*a*) Algeria	19,460	23,970	20,800
(*b*) Madagascar	2,190	2,480	15
(*c*) Cameroons	28	55	...
Total	21,678	26,505	20,815

C.—Purchased from foreign countries—			
(a) ordinary	53,950	22,820	50,520
(b) superior	12,830	10,420	11,650
Total	66,780	33,240	62,170
Grand Total ...	139,698	123,715	140,885

Of the 139,690,000 lbs. of tobacco purchased by the monopoly in 1929, 52 per cent. was obtained either from internal supplies or from colonial sources, the balance being imported from foreign countries. The amount annually purchased abroad is liable to great fluctuations, more or less dependent on the success or failure of the local and colonial crops.

Analysis of Sources and Kinds of Tobacco Purchased Abroad.
(Source of Tobacco C.)

The following tables analyse the amount of imported tobacco purchased.

C.—*Quantity of Leaf Tobacco Purchased from Foreign Countries.*

(a) Ordinary.

Country or Origin.	Variety.	1929. 1000lbs.	1928. 1000lbs.	1927. 1000lbs.
United States	1. Kentucky light	15,000	14,000	19,470
	2. Seed leaf	3,470	2,983	10,952
	3. Virginia dark	648	356	664
	4. Kentucky coarse	750	1,200	997
	5. Virginia common bright	10,110	100	...
St. Domingo	6. St. Domingo ordinary ...	5,512	...	2,845
	7. St. Domingo Hanava seed	152	241	...
Dutch Indies	8. Java Crossoh	7,400	1,011	10,520
Phillipine Island	9. Manilla...	2,686	...	2,427
Hungary	10. Hungary	6,530	2,685	...
Colombia	11. Carmen	362	...	...
Germany	12. Bade	...	...	2,645
Bulgaria ... ... Greece ... ... Turkey	13. Orient common...	1,154	...	...
Turkey	14. Scraps d'Orient...	168	222	...
Other	15. Samples	8	22	...
	Total quantity	53,950	22,820	50,520

C.—(*a*) *Average Value of Ordinary Tobacco in pence per lb.*

Variety.	Class of manufacture for which these tobaccos are used.	1929. d. per lb.	1928. d. per lb.	1927. d. per lb.
1. Kentucky light... ...	Scaferlati ordinary and superior	5.48	5.10	4.13
2. Seed leaf...	„ „ „	5.38	4.81	4.19
3. Virginia dark	Snuff	5 69	6.48	5.46
4. Kentucky coarse ...	Rolls of tobacco	9.03	8.28	5.71
5. Virginia c. bright..	Scarferlati ordinary...	4.96	4.15	...
6. St. D. ordinary .	Scarferlati ordinary cigars and cigarettes	3.66	. .	3.94
7. St. D. Havana seed	Sous-capes and interiors of cigars	3.74	5.48	...
8. Java Crossoh .	Interior of cigarillos	2.90	3.23	3.07
9. Manilla	Scarferlati ordinary...	4.31	. .	4.01
10. Hungary	„ „	3 82	3.56	...
11. Carmen	„ „	4.00	..	..
12 Bade	„ „	.	. .	5.36
13. Orient common	„ „	4.64	..	...
14. Scraps d'Orient	„ „ . ..	1.28	1.29	.
15. Samples	„ „ .	.	. .	..
Mean value (calculated on average rate of exchange for the years in question)		4 55	4.92	4.12

C.—(*b*) *Superior.*

Country or Origin.	Variety.	1929. 1000lbs.	1928. 1000lbs.	1927. 1000lbs.
United States	1. Maryland pure	2,500	6,400	3,750
	2. Maryland common .	185	282	1,000
	3. Virginia bright. . .	600	486	998
Cuba	4. Havana . . .	238	182	57
Brazil	5. Bahia	2,655	687	1,058
Dutch Indies	6. Sumatra	831	941	760
	7. Java Vorstenlanden ..	4,000	880	2,285
	8. Java Besoeki	140	...	42
	9. Java Loemadjang .. .	237	.	. .
Bulgaria .. .. Greece .. .. Turkey	10. Orient	1,435	562	1,700
	Total quantity	12,830	10,420	11,650

C.—(*b*) *Average Value of Superior Tobacco in pence per lb.*

Variety.	Class of manufacture for which these tobaccos are used.	1929. d. per lb	1928. d. per lb.	1927. d. per lb.
1. Maryland pure	Scarferlati Maryland . ..	11 56	10.70	8.88
2. Maryland common	Scarferlati ordinary..	5 66	3.79	3.68
3. Virginia bright... . .	Scarferlati virginia	16.80	15.51	15.92
4. Havana	Cigars and cigarillos	13.73	20.90	21.64
5. Bahia	Cigars and cigarillos	9 67	8.92	6.45
6. Sumatra	Cigar covers	48.50	28.25	28.60
7. Java V.	Sous-capes and interior for cigars	9 99	12.80	11.45
8. Java B.	Sous-capes for cigars	13.32	9.98	15.41
9. Java L.	Scarferlati Maryland	7.94	.	...
10. Orient	Products in Orient tobaccos	14.53	19.12	12.85
	Mean values	13.52	12.88	11.23

The bulk of the purchases from foreign countries are classified as ordinary tobacco with an average value ranging from 4d. to 5d. per lb. during the years in question. This average price includes the amount paid for the tobacco plus all expenses, incurred in delivering the tobacco to one of the factories.

The mean value of the better class tobaccos ranged from 11d. to 1s. 1½d. per lb. These tobaccos are of a specialised nature, rarely to be found in any quantity anywhere in the British Empire. There is no doubt, however, that the French market might be of great use to the Empire as an outlet for the cheaper quality tobaccos which are now classified as unsaleable on the English market.

Rhodesian Timbers for Paper Pulp.

By the Division of Forestry.

During the course of last year arrangements were made through the High Commissioner in London to have representative samples of *Pinus radiata* (*insignis*), *P. patula* and *Cupressus lusitanica* physically and chemically examined with a view to obtaining an opinion as to their suitability for paper pulp.

One log of each species was selected by the Chief Forest Officer from plantations at Inyanga. These were subsequently despatched for examination to the Imperial Institute in London.

The results of the examination of these woods revealed that their average length of fibre was greater than the average length of fibre of New Zealand grown *P. radiata*. Further it was shown that with the exception of *C. lusitanica* the percentage of cellulose in the Southern Rhodesian samples was slightly greater than the percentage of cellulose in samples of New Zealand grown *P. radiata* which had been examined.

As these results appeared to be so satisfactory the High Commissioner asked for a laboratory paper making test to be made.

The investigations showed that pulp made from all three woods submitted would, no doubt, prove suitable for the manufacture of strong Kraft wrapping papers and also that the Pine woods examined should present no difficulty in converting them to wood pulp suitable for newsprint. It is considered, however, that pulp made from the *C. lusitanica* wood submitted would be less suitable for the latter purpose and would probably produce a rather strongly coloured pulp.

The following are extracts from the report:—

"For the purpose of pulping trials representative samples taken from the three logs were reduced to chips and treated

with caustic soda under experimental conditions similar to those employed commercially for the production of pulp by the soda process.

The examination of these three woods has shown that they all furnish very good yields of strong, long-fibred pulp under relatively mild experimental conditions of treatment and with a low consumption of alkali. The pulps obtained furnished papers possessing excellent strength and generally similar in appearance and character, but (as previously observed at the Imperial Institute in the case of pulps obtained from coniferous woods) the pulps were very resistant to the action of bleaching solutions, so that it was not possible to reduce them easily and satisfactorily to a good pale colour. It is probable that by more drastic cooking treatment a whiter product could be obtained, but only at the expense of the yield of pulp.

In actual practice the yields of pulp would be rather lower than those obtained in the present case under experimental conditions, but it is unlikely that they would differ materially from the yield normally found for coniferous woods, *i.e.*, about 45 to 55 per cent. from the oven-dry wood.

Judging from the character of the pulps obtained in the present investigation there is little doubt that all three woods would be suitable for the manufacture of strong Kraft wrapping papers, by either the soda or the sulphate process. Further, taking into consideration the appearance and colour of the Pinus woods examined and the fact that the resin contents are low, no difficulty should be experienced in using these woods for making mechanical wood-pulp for newsprint. Owing to its rather dark colour and knotty character the Cupressus wood would be less suitable for this purpose, and it is likely that a rather strongly coloured pulp would result."

Co-operation in Empire Agricultural Research.

EXECUTIVE COUNCIL OF THE IMPERIAL AGRICULTURAL BUREAUX.

ANNUAL REPORT.

The fourth annual report of the Executive Council of the Imperial Agricultural Bureaux issued recently continues the story of the smooth and successful working of an imperially controlled and financed organisation.

The fourth report marks the end of the two years' term of office of Mr. F. L. McDougall, C.M.G., the representative of Australia, as Chairman of the Council, and notes that for the next two years Sir Charles J. Howell Thomas, K.C.B., K.C.M.G., the United Kingdom representative, has been elected Chairman with Mr. Nevill L. Wright, New Zealand, as Vice-Chairman.

The most important event in the year for the Bureaux was the enquiry made into the work and organisation of the Bureaux, in common with that of other inter-Imperial organisations, by the Imperial Committee on Economic Consultation and Co-operation, appointed as a result of one of the resolutions of the Ottawa Conference. That Committee of Enquiry not only recommended the continuance of the work, but accepted the organisation as a general model for inter-Imperial organisations and proposed that additional duties be placed on the Council.

The main functions of the Bureaux are the collecting, sifting and distributing information on research in eight branches of agricultural science. In pursuance of this, abstract journals which were started have now become well established, *viz.*, from the Bureau of Animal Health, Wey-

bridge, *The Veterinary Bulletin;* from that of Animal Nutrition, Aberdeen, *Nutrition Abstracts and Reviews;* from that of Plant Genetics (Non-Herbage), Cambridge, *Plant Breeding Abstracts;* from that of Plant Genetics (Herbage), Aberystwyth, *Herbage Abstracts;* from that of Fruit Production, East Malling, *Horticultural Abstracts;* from that of Soil Science, Rothamsted, *Monthly List of Publications;* from that of Agricultural Parasitology, St. Albans, *Helminthological Abstracts* and the *Bibliography of Helminthology;* from that of Animal Genetics, Edinburgh, *Annual Breeding Abstracts.*

In addition a number of reviews with bibliographies on special subjects were issued, and the issue from Weybridge of the Index Veterinarius—a complete index of all papers and publications on veterinary science—was sanctioned.

It is often said that it takes thirty years to transfer the results of research into general farming practice. However that may be, research workers generally had found increasing difficulty in keeping abreast of progress in all parts of the world in their own subjects. To meet that difficulty for research workers in the Empire, these Bureaux were organised, at their request, and are financed by contributions from all Governments of the Empire and are controlled by a Council composed of members appointed by those Governments. The offices of the Council are at 2, Queen Anne's Gate Buildings, London, S.W.I.

A Promising Fodder Plant.

By H. C. ARNOLD, Manager, Salisbury Experiment Station.

Now that cattle owners are paying increased attention to the establishment of improved pastures, and the need for fodder rich in protein is realised, the leguminous shrub known as *Lucæna glauca*, or Vi-Vi, should find a place among other pasture plants in trial plots with a view to determining the extent to which it is suitable for this Colony's conditions.

This small tree or shrub is indigenous to South America and some of the Pacific Islands, where it has been used as a cattle feed for many years with satisfactory results, and there is reason to think that it might prove useful to stockmen in this Colony. It grows to a height of 10 or 12 feet in a period of three or four years. The foliage and flowers resemble some of our native thorn trees, but the Vi-Vi has no thorns whatever, and because of this cattle can browse the plants, and consume all the leaves, seed pods and woody parts of the branches up to the thickness of a lead pencil, without any discomfort or danger from thorns.

A small quantity of seed was sown at the Agricultural Experiment Station, Salisbury, in the year 1924, and as the resulting trees attained their normal height in 3 years and appear healthy in every way, it is assumed that the conditions here are suitable for them. Although they are now ten years old there is no apparent diminution of their vigour, and they invariably produce two prolific crops of seed per annum.

Branches of the current season's growth of this shrub, consisting of sticks, leaves and seed pods, were collected towards the end of June, 1933, and submitted to the Chief Chemist for analysis. The results showed that the dry material contained 21.4 per cent. of crude protein, 45 per cent. of carbohydrates and only 22 per cent. of crude fibre. This gives a nutritive ratio when calculated from the crude nutrients of 1:3.5. Thus the branches of Vi-Vi actually

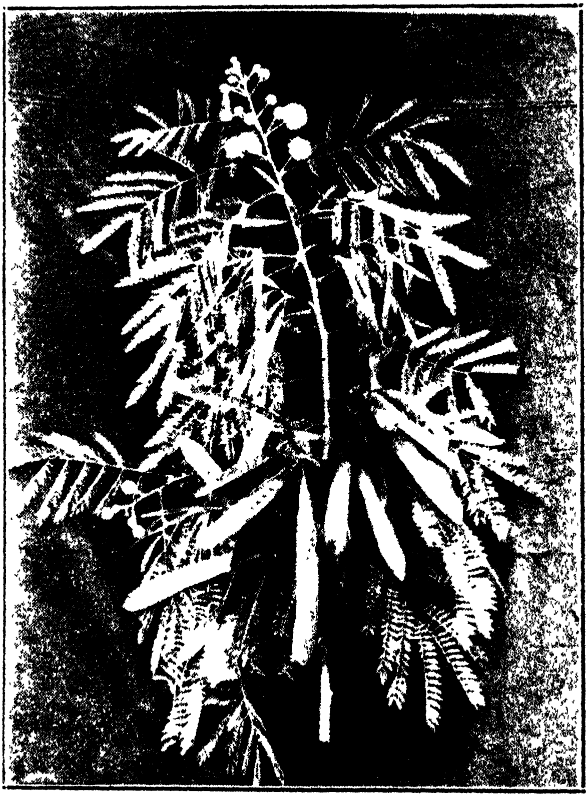
contain more protein and less fibre than is found in average commercial samples of lucerne, clover and other leguminous hays. It appears, therefore, that fodder so rich in protein would form an excellent supplement to our pastures, because during the Autumn and Winter months these are usually deficient in that most important nutrient.

Although the annual yield of fodder would probably be lower than that of such crops as cowpeas and dolichos beans, it has the advantage of being perennial, as well as the ability to retain its freshness for three or four months after the seasonal rains, which make it possible to allow cattle to browse the fodder on the shrubs and so obviate the necessity for preserving it in the form of hay or silage. After the initial outlay for planting the crop, which would about equal that incurred for the annual hay crops, the only expense would be that of protecting the shrubs from the depredations of cattle during the summer months, and a valuable crop of rich fodder would be available each and every Autumn for several years, though the quantity would be small during the first season owing to the slow growth of the seedling plants.

Severe frosts cause the leaves to fall, and may cause seedling plants to die back to the ground level, but these sprout again upon the return of warm weather. In no instance, at Salisbury, has the injury from frost been so severe as to entirely destroy the plants.

In some places these trees are used to provide light shade and protection from wind, as in young coffee plantations, and it is thought possible that it might be used to advantage in artificial pastures for the same purpose. Used in this way it might be found that heavier crops of grass would be produced in addition to the fodder provided by the trees. The chief objection to such a scheme would be that the trees would prevent the use of hay-making machinery. This could be overcome by planting the Vi-Vi in single rows or narrow belts with the pure pasture between.

It has been suggested that Vi-Vi might be found useful for planting on contour ridges. By close-planting protective hedges could be formed, which would not only provide protein to balance the carbohydrates of the maize stalks, but they



Vi Vi, showing leaves flowers and pods

would help to prevent the formation of useless cattle paths across the ridges, check wind erosion, and by collecting wind-borne vegetable trash help to build the ridges higher and thus increase their effectiveness.

Seed is produced in profusion, and this permits of the establishment of the crop at a small cost. The seed coats are hard, and should be treated with boiling water and allowed to soak for 12 to 24 hours before sowing. Usually only about 50 per cent. of the seed germinates.

Trials conducted in Ceylon showed that when the seed is boiled and crushed it makes a very useful cattle feed. Seed production of the trees at the Agricultural Experiment Station is at the rate of 600 lbs. to 800 lbs. per acre per annum.. This indicates that stockmen might find the crop of seed of considerable value for feed purposes.

Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants

SUITABLE FOR THE COLONY.

By J. W. BARNES, Manager, Government Forest Nursery, Salisbury.

(Photographs by the Author.)

Passiflora cærulea.—A useful very rapid climber; evergreen; has not fruited here.

Passiflora edulis (Granadilla).—This evergreen climber is well known as it grows like a weed nearly everywhere; produces purple fruits in abundance. Seeds or cuttings.

Passiflora quadrangularis.—This variety is similar to the above, but has larger fruits. It does not grow so readily as *P. edulis.*

Passiflora sp. (Fiji Granadilla).—A large-leaved heavy climber, with large yellow fruits; is good as a strong climber; fruits, however, do not really come to perfection here.

Passiflora sp.—A pretty pink-flowered variety; a useful evergreen climber, bearing long narrow yellow fruits.

All are raised by seeds or cuttings, and all are tender to heavy frosts; young plants must be protected during cold weather.

Pereskia aculeata (Barbados Gooseberry).—An exceedingly rank and thorny creeper, even the small fruits are covered with spines; makes a good cattle proof fence. Cuttings.

Persea gratissima (Avocado Pear).—The Avocado pear is now fairly well known, and is found to grow fairly well in most parts of Mashonaland, but not in the coldest areas; fruits well, but the tree only just grows successfully here, as shown by the fact that branches are usually found to be dying back

on the trees after they are a few years old. Most of the older trees were raised by seeds, but during the past few years budded trees have been imported.

Petræa volubilis (Purple Wreath).—A straggly climber, which may be trained into a shrub; deciduous; flowers in Spring; has long racemes of deep purple-coloured flowers and is a beautiful object; small plants tender to frosts. Propagated by layers or cuttings.

Phaseolus lunatus (Seven-Year or Lima Bean).—A most luxuriant climber, which is useful as a quick growing screen; deciduous, but the vines live and throw out new growth early in Spring; is a good table bean; the dry beans soaked and boiled are an excellent vegetable. Seeds.

Philadelphus grandiflorus (Mock Orange).—Deciduous shrub up to 10 feet high; flowers in Spring usually before the leaves appear. Flowers white. Cuttings.

Several varieties are grown, all with white flowers, some being double.

Phoenix canariensis.—A species of the date palm, with large fronds; will make a good specimen; hardy. Seeds.

Phoenix dactylifera (Common Date Palm).—The date of commerce thrives slowly, making in time a handsome specimen, but will probably not fruit here; it is probable, however, that a place may be found in the Colony where it will bear fruit. Seeds.

Phoenix reclinata (False Date Palm).—A palm of the date family which is indigenous to the Colony and reaches a height of 15-20 feet; graceful and hardy. Seeds.

Phormium tenax (New Zealand Flax).—A useful ornamental plant, with sword-like leaves, up to 6 feet in height; the leaves are thrown out from the base at ground level; it is a valuable fibre plant, and there are lots of uses to which the leaves can be put, such as thatching, tying up plants, etc.; the dead and old leaves soaked in water and pulled into strips make an excellent tying material. Offsets or seeds.

Also a variegated variety, is very ornamental.

Physalis peruviana (edulis) (Cape Gooseberry).—The well known Cape Gooseberry, usually grows like a weed, and fruits profusely. Seeds.

Phytolaca dioica (Belhambra).—A rapidly growing tree up to 40 feet in height, with large soft branches and dense foliage; large surface roots are a drawback and are dangerous near buildings. The tree is used in Australia as a cattle fodder in times of drought. Seeds.

Pinus canariensis (Canary Island Pine).—Is hardy to most parts of the Colony, slower in growth than some of the other pines; it is making a good tree in Mashonaland. Seeds.

Pinus cembroides (Mexican Nut Pine).—A small beautiful tree very suitable for gardens, but thrives only on the Eastern Border. Seeds.

Pinus halepensis (Aleppo Pine).—A very hardy pine, doing fairly well in Matabeleland; is sometimes used as a hedge in Mashonaland. Seeds.

Pinus longifolia (Chir Pine).—Another good hardy tree growing well in most parts of the Colony. Seeds.

Pinus muricata (The Bishop's Pine).—Will grow into a timber tree on the Eastern Border. Seeds.

Pinus patula (Spreading-Leaved Pine).—Introduced in 1920; this handsome pine competes with *P. radiata* in rate of growth at Inyanga, on the Eastern Border, and will no doubt be of the greatest value to the Colony as a first-class timber tree. Seeds.

Pinus pinaster (Maritime or Cluster Pine).—Growing well on the Eastern Border, though much slower than *P. radiata.* Seeds.

Pinus radiata (Monterey or Remarkable Pine).—Up till recently called *Pinus insignis;* this tree has been a great success on the Eastern Border, in the Inyanga and similar districts, and is of first-class importance as a timber tree for this Colony in that district. Three or four trees planted about twenty years ago at Sir Ernest Montagu's residence at Borrowdale, Salisbury, on a contact soil, have done very well, and it

seems that the tree will do best in contact or granite soils, and dies out badly in heavy diorite soils. It should be planted with caution in areas under 30 inch rainfall. Seeds.

Pinus tæda (Loblolly Pine).—Another variety successful on the Eastern Border. Seeds.

Pittosporum undulatum (Camphor Laurel).—The favourite hedge plant in and around Salisbury, where miles of healthy hedges may be seen. It is a bright green in colour, has dense foliage and stands up to the dry winters better than would be expected. Is also a useful small shrubbery specimen tree. Seeds.

Plumbago capensis (Plumbago).—A good, well known shrub, but deciduous unless watered during the dry season; has beautiful, light blue flowers. Seeds or cuttings. There is also a white variety.

Plumeria occulata (Frangipani).—As below, but with creamy-white flowers. Cuttings.

Plumeria rubra (Frangipani).—Has thick succulent branches and large dark green leaves; covered in Summer with terminal cymes of fragrant yellowish-pink flowers; is not hardy to very heavy frosts, and should be protected while small. Cuttings.

Podranea bryceι (Zimbabwe Creeper).—An indigenous creeper, and a rank grower in cultivation, but when in flower it makes a wonderful show with its large heads of pink flowers. Seeds or cuttings.

Poinciana gillessii (Bird of Paradise Flower).—A small deciduous shrub, about 10 feet high, having in Summer masses of red edged with gold flowers, and is a beautiful object. Seeds.

Also a fine yellow variety similar to above. Seeds.

Poinciana regia (Flamboyant).—A large flat-topped spreading tree, usually about 20-30 feet high, covered in Spring with bright scarlet flowers; is an excellent street tree, but large surface roots are rather troublesome. Trees of this variety were planted in the main street of Umtali many years ago and are famous for the wonderful show they make; unfortunately many of these trees have been removed during recent years, which has rather spoilt the effect. Seeds.

Poinsettia albida.—A variety with pale yellow bracts, not so effective as the red, but useful in large shrubberies

A rose-pink variety is also grown, but requires partial shade, otherwise the hot sun bleaches the bracts to a yellow colour.

This variety is not a fixed type, and often reverts to single red. Cuttings.

Poinsettia pulcherrima.—A shrub with red bracts growing to 12 feet in height, spreading; deciduous; the Poinsettia grows to perfection, but sometimes in exposed situations the flower bracts are damaged by frosts; heavy pruning is beneficial, especially if large heads are required, and with a little attention can be grown with a diameter of 18 inches. Cuttings.

Poinsettia sp.—A double form is also grown, and is valuable as it is of a darker red and flowers later than the single. Cuttings.

Populus alba (White Poplar).—This tree is useful along stream banks and other moist well-drained places. It is a mistake to think that they can be planted in wet sour vleis and expected to grow successfully; if the ground cannot be ploughed and sweetened, raised mounds should be thrown up and allowed to weather, forked over in the Spring, and the suckers then planted; after being successfully established they will soon run into the wet surroundings and send out more suckers. Suckers.

Populus deltoidea var. *Missouriensis* (Carolina Poplar). —A variety introduced in 1921, and has grown well. Of the original cuttings put in at Salisbury in September, 1921, three of the rooted trees were left in and the balance moved to other quarters; the largest of the three trees left is to-day 55 feet high and 16 inches diameter, breast high; this variety seldom sends up suckers. Cuttings.

Psidium cattleyanum.—Erroneously called the Chinese guava locally; this is an evergreen small shrub up to 6 feet high and bearing small dark purple fruits which look something like strawberries; well worth cultivation for the fruits. Seeds.

Psidium pomiferum (Guava).—A small hardy evergreen tree bearing a well known fruit, pink-fleshed; there is also a white-fleshed kind. Seeds.

Pueraria thumbergiana (Kudzu Vine).—Useful rough creeper, with dense green foliage, used sometimes as a climber on trellis work; is a valuable fodder plant and grows to perfection here for this purpose. Layers, seeds or crowns.

Punica granatum (Pomegranate).—A shrub about 15 feet high; deciduous; single scarlet flowers, followed by large brightly coloured fruits. Seeds.

Also a double red flowered variety, and a double red-yellow flowered variety are grown, double kinds propagated by cuttings as they do not bear fruits and are deciduous.

Quercus ilex (Holly Oak).—Has grown slowly in Salisbury and reached a height of 13 feet in 15 years. Seeds.

Quercus pedunculata (Common Oak).—Trees of this type have reached a height of 50 feet on the Eastern Border, but it is a waste of time to plant it elsewhere. Seeds.

Rhamnus prinoides.—An indigenous small shrub, having bright shiny leaves. Has been tried as a hedge fairly successfully, though many other plants are more suited for this purpose.

Rhapis flabelliformis.—A slender palm, about 4 feet high, fan-leaved, with narrow leaflets, useful as a verandah plant; it throws up suckers from which it is propagated.

Rhus lancea (Karee Boom).—An indigenous small shrubby tree, evergreen and excellent as a rough hedge screen; quick grower. Seeds.

Rhus succedanea (Red Lac Sumach or Japanese Wax Tree).—A small shrubby tree; has so far reached a height of 10 feet; has large dark green pinnate leaves, turning to a fiery red in Autum before falling. Seeds.

Rhus vernicifera (Chinese Lac Tree).—A small evergreen tree up to 20 feet high; has heavy bright green foliage; has thrived, but is tender to frosts the first year or two. Seeds.

Rhynchospermum jasminoides or *Trachelospermum jasminoides* (Star or Malayan Jasmine).—An evergreen dwarf creeping shrub, usually about 2 feet high, but can be trained up a trellis; is covered in Summer with clusters of small pure white flowers, highly scented. Cuttings.

Ricinus communis (Castor Oil Plant).—From the frequent occurrence of this plant in the veld in the Inyanga district I conclude that it is probably indigenous to the Colony; it is very easily grown and has been seen growing naturally to a height of 10 feet. Some of the highly coloured varieties would probably do well and be a useful addition to our shrubberies. Seeds.

Romneya coulteri (Californian Poppy).—Shrubby herbaceous plant producing large single white scented flowers; evergreen; height to 6 feet. Suckers.

Roses.—Roses, of the hybrid, hybrid teas, polyanthas, and one or two of the climbing polyanthas and Winchurian do well in the heavy soil districts, but many of the good climbing varieties will not thrive and flower freely, unless in the mist belt.

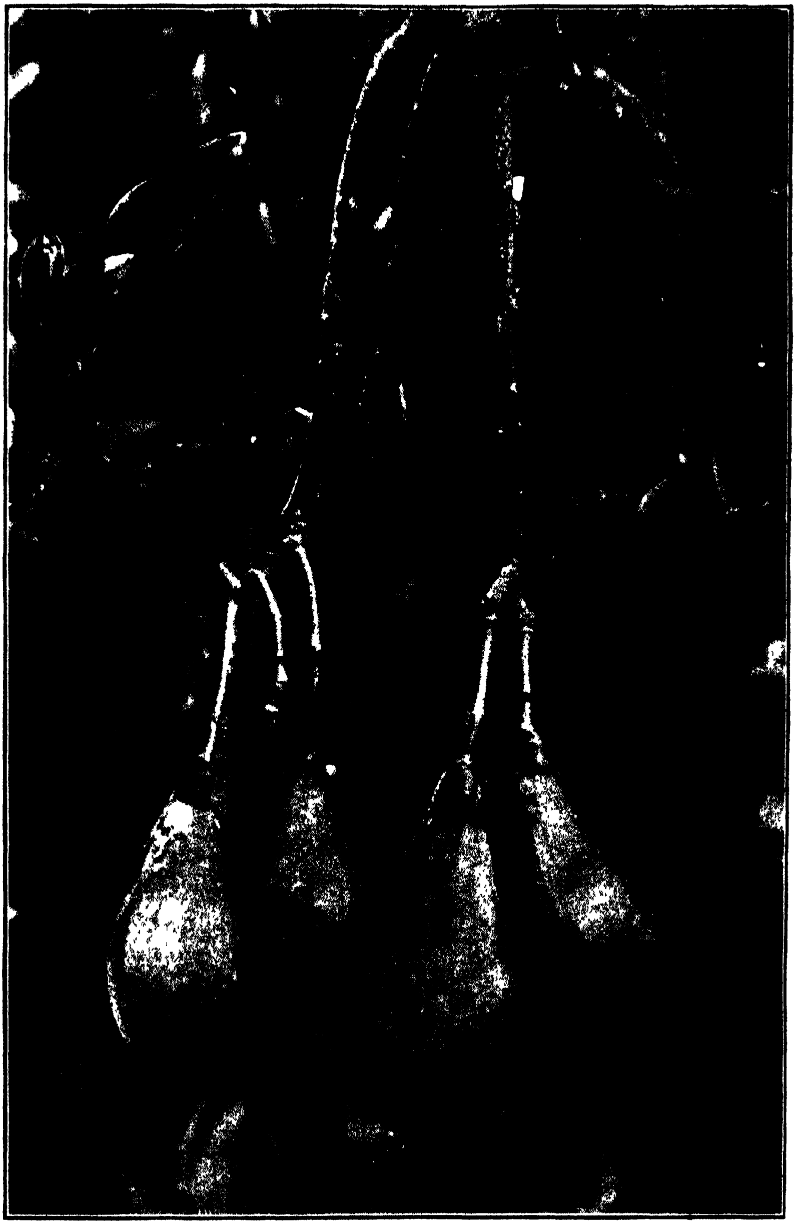
The best results with hybrid perpetuals and hybrid teas are obtained from plants raised from cuttings; plants on stock are a perfect nuisance, as they are always throwing out suckers if the roots are at all damaged while cultivating.

Rosa bracteata (Macartney Rose).—A very strong-growing climbing rose; evergreen; flowers profusely in Spring; has large single white flowers; makes an excellent cattle proof hedge, and looks well if regular attention is given to it; but if allowed to grow unchecked becomes very straggly. Cuttings.

Rosmarinus officinalis (Rosemary).—A small shrub to 5 feet with small purple flowers; it is for the aromatic leaves the shrub is grown. Cuttings.

Russelia juncea (Coral Fuschia).—A charming plant suitable for the edge of the shrubbery, growing to about 4 feet high, and throwing out new growth from the base; like asparagus. Has large spikes of small red flowers, which are excellent for cutting. Cuttings.

Eucalyptus maculata (Spotted Gum).—Fine trees growing in the Public Gardens, Umtali.



Persea gratissima (Avocado Pear).--A photograph taken in 1923 at the residence of Mr. Justice McIlwaine, Orange Grove, Salisbury These were probably the first trees to bear fruit in the Colony.

Salix babylonica (Weeping Willow).—A rather large tree up to 30-40 feet high, in a favourable spot; a valuable timber tree and is useful for stock feed; its long drooping branches are very effective, especially when grown along river banks. Cuttings.

Salix purpurea (Osier Willow).—One of the true Osiers, and valuable for basket making, and for which the weeping willow may also be used. This variety will grow to 10 feet in height, and will produce useful rods in two or three years. Cuttings.

Salvia involucrata.—A large herbaceous shrub to a height of 8 feet in well prepared soil carrying large heads of rosy-crimson flowers in late Summer; requires feeding and cutting back each season for the best results; tender to frost. Cuttings.

Schinus molle (Pepper Tree).—A well known evergreen tree, up to 25 feet high; well grown specimens are handsome shade trees; good specimens are to be seen in the Bulawayo area. Seeds.

Schinus terebinthifolius.—A small to large spreading evergreen tree, which is covered in Spring with small red berries. Seeds.

Schizolobium excelsum.—An extremely rapidly growing tree having large pinnate leaves and large sprays of yellow flowers in Spring; has grown to a height of 40 feet in five years in Salisbury Gardens. Seeds.

Seaforthia elegans or *Ptychosperma cunninghamiana* (Illawara Palm).—A fine large palm for verandah, or shade house, but will not stand the sun. Seeds.

Securidaca longipedunculata (Rhodesian Violet Tree).—A small deciduous indigenous shrubby tree with small leaves, bearing early in Spring masses of small reddish flowers scented like violets. Is raised from seeds, which are very difficult some years; is very slow growing, and usually dies when transplanted. Probably the only successful way to grow this is by sowing *in situ*, and when a year or two old to plant other plants near to draw it up more quickly.

Senecio macroglossus (Cape Ivy).—An evergreen climber, bright shiny leaves, and large single yellow flowers; is a rapid and showy climber. Cuttings.

Smilax sp.—Deciduous climbers, sending out new growth yearly; useful shade house plants. Two or three varieties are indigenous to the Colony. Seeds or roots.

Solanum seaforthianum.—A small flowered variety of the potato creeper, growing to 8 feet; evergreen climber; pretty blue flowers, followed by bright red berries. Seeds or cuttings.

Solanum Wendlandii (Potato Creeper).—A strong-growing rough climber, requiring plenty of room, such as a windmill tower, to show it to best advantage; damaged by frost. Cuttings.

Spathodea campanulata (African Flame Tree).—A handsome large-leaved tree to 25 feet in height with large red flowers edged with gold; valuable as a street tree, when it should be planted at least 25 feet apart; tender to frosts while small; requires deep well drained soil; flowers in April-June; deciduous. Seeds.

Spiræa prunifolia (Cape May).—A deciduous shrub, to 6 feet high, is covered in early Spring with masses of double white flowers; is sometimes used as a hedge. Cuttings.

A single white flowered variety is similar.

Stephanotis floribunda (Madagascar Jasmine).—An evergreen climber with dark fleshy leaves and lovely white scented flowers; requires partial shade and will do on a south wall. Seeds.

Sterculia acerifolia (Australian Flame Tree).—This is a beautiful tree, with large bright green leaves, and in Spring has crimson flowers; grows to 20 feet in height; the tree is not really a success as it is inclined to die out after a few years. Seeds.

Sterculia diversifolia.—A small evergreen tree growing only to about 15 feet in 20 years at Salisbury; is a valuable tree and used in Australia as a stock food. Seeds.

Sterculia sp.—This variety is probably *S. discolor;* is a handsome flowering tree, and some fair specimens are to be seen in the streets of Salisbury, but like *S. acerifolia* it is doubtful if this species will live long. Seeds.

Strelitzia reginæ (Crane's Head).—A large herbaceous plant useful for the shrubbery; grows up to 5 feet in height

and has large leaves something like the canna; produces curiously shaped flowers which strikingly resemble a Crane's head. Division of roots.

Streptosolen jamesonii.—A favourite evergreen shrub, with large heads of small orange-red flowers, flowering profusely in June-July; the flowers are damaged by frost unless in a sheltered situation. Cuttings.

Strobilanthes sp.—A small evergreen herbaceous shrub to 4 feet in height; covered with small deep blue flowers in Autumn. Cuttings.

Tecoma smithii.—A large yellow-flowered shrub up to 15 feet high; deciduous; fast grower. Seeds.

Tecoma stans (Yellow Elder).—Similar to *T. smithii*, but is not quite so large. Flowers reddish-yellow. Seeds.

Tecomaria capensis (Kaffir Honeysuckle).—A straggly creeping shrub, but a pretty plant if care is taken of it; flowers reddish-orange. Seeds or cuttings.

Thevetia neriifolia.—A bright-leaved evergreen shrub, tender to heavy frosts, golden yellow flowers. Seeds.

Thuja orientalis (Thuja).—A hardy conifer used as a hedge or small tree; height about 20 feet. It is not very satisfactory as a hedge, as odd plants have a habit of dying out for no apparent reason. Seeds.

Tithonia diversifolia.—A large herbaceous shrub, growing to a height of 10 feet, dying down to the crown each winter; large spikes of yellow flowers very similar to sunflowers. Seeds. Offsets.

Tithonia speciosa.—A small variety, to 4 feet with single red flowers. Seeds.

Trichelia emetica.—A large evergreen tree, with large dark green leaves; rather slow in growth but making a fine shade tree; tender to frosts whilst small. Seeds.

Ulex europæus (Furze, Gorse or Whin).—This well known shrub grows well at Inyanga on the Eastern Border, about 6 feet in height; evergreen; golden yellow flowers. Seeds.

Viburnum opulus (Guelder Rose).—A deciduous shrub; height up to 4 feet, large heads of white flowers; probably only successful on the Eastern Border. Cuttings.

Washingtonia robusta (Cotton Palm).—A very fine hardy palm for avenues, or specimen purposes, and is fast growing; requires deep well-drained soil, and has done best on raised mounds. Seeds.

Widringtonia whytei (Mlanje Cedar).—An indigenous coniferous tree, growing in the mountains of the Eastern Border, usually to about 25 feet in height, and about 6 inches diameter; the tree thrives best where water is seeping around its roots; produces a fine and valuable timber, some of which is used in hut roofs at Inyanga and is as good after 25 years as the day it was cut. This conifer will coppice freely after the trees are felled. Seeds.

Wigandia macrophylla.—A large-leaved strong growing herbaceous shrub; height to 10 feet; has large terminal cymes of purple flowers. The whole plant is covered with fine spiny hairs, which if touched are very irritating; requires plenty of room to develop properly. Suckers.

Wistaria chinensis (Chinese Kidney Bean Tree).—This well known climber, although odd plants grow well, does not flower very readily. Seeds.

Zantedeschia africana (Arum Lily).—Although such a common plant in the Cape, this plant requires regular attention to grow to perfection in this Colony, and is best grown in the shade house or verandah. A pretty yellow species (*Z. melanoleuca*, Engl.) is indigenous to the Colony, and very common. Division of roots.

Zitheryllum sp.—A large shrub, growing to about 15 feet high, and spreading leaves something like *Lagerstrœmia reginæ*, which turn a lovely brownish-yellow colour before falling in winter. Cuttings.

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 19, June, 1934.

The position during June has remained much the same as during May. Large swarms of Red Locusts (*Nomadacris septemfasciata*) have been reported from most districts in the Colony, but they are apparently not moving about to any great extent and have attracted little notice. There has been no indication of any tendency towards definite migration, the movement of the swarms being quite irregular and including most points of the compass.

No evidence has been collected of the presence of the Tropical Migratory Locust (*Locusta m. migratoriordes*) in any part of the Colony.

Enemies and Disease.—No reports have been received nor observations made concerning any concentration of enemies in the winged swarms. The locust fungus, *Empusa grylli*, is, however, apparently still active, at least in the Melsetter district, where exceptionally humid conditions have prevailed during the month. Natives report great mortality amongst the locusts in P.E. Africa for several months past, attributing it to both disease and maggot infestation.

Damage.—No reports of serious damage have been received during the month.

Outlook.—There is no definite change in the outlook.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

MAY, 1934.

AFRICAN COAST FEVER.

No cases of this disease.

TRYPANOSOMIASIS.

Eleven cases in the Melsetter district and two in the Lomagundi district.

ANTHRAX.

One case in the Mtoko district, the incontacts were inoculated.

HORSESICKNESS.

One case reported in the Charter district.

TUBERCULIN TEST.

One bull and ten heifers were tested on importation; no reaction.

MALLEIN TEST.

Twenty horses were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Bulls 1, heifers 10, horses 12, sheep 409, goats 110.

EXPORTATIONS.

Horses 2, sheep 154.

Cattle to Durban for export overseas 2,920. To Johannesburg for local consumption 593.

To the United Kingdom *via* Union Ports in Cold Storage: Beef quarters 10,074, boned quarters 1,698; veal quarters 304, boned quarters 162; tongues, 13,989 lbs.; livers, 28,457 lbs.; hearts, 9,826 lbs.; tails, 5,336 lbs.; skirts, 5,436 lbs.; shanks, 7,262 lbs.; kidneys, 662 lbs.; cheeks, 3,999 lbs.

Meat Products from Liebig's Factory:—Meat meal, 105,300 lbs.; bone meal, 284,000 lbs.; beef fat, 25,420 lbs.; tongues, 5,400 lbs.; tallow, 1,663 lbs.; blood meal, 360 lbs.; meat extract, 25,699 lbs.; meat residue, 315 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JUNE, 1934.

Pressure.—Mean pressures for the month were generally high and the usual gradient from the South to North was steeper than normal.

Temperature.—The temperature for the month was generally above normal. The maxima recorded were generally low, but the minima were very high. The mean minimum at all stations appears to be the highest ever recorded. At Bulawayo the mean minimum was 48.8°, the previous highest being 47.9° in 1922, 47.8° in 1914 and 47.0° in 1900.

Weather.—The cloud amount and rainfall were generally very much in excess of normal, Bulawayo recorded 0.35 inches on three days with traces on two other days, the previous maximum being 0.15 ins. Salisbury recorded 0.28 on 8 days with traces on 5 other days, the previous maximum being 0.66 ins.

JUNE, 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	82	47	72.6	55.6	64.1	61.6	59.7	56.2	80	54	...	1.08	.12	7	...
Beit Bridge	972.6	...	86	41	76.8	50.3	63.6	...	62.3	55.6	65	51	3.2	...	...	...	1,510
Bindura...	896.7	...	79	42	73.5	50.3	61.9	...	59.4	53.4	68	49	2.3	.09	.02	1	3,698
Bulawayo	873.8	873.1	77	41	67.4	48.4	57.9	57.3	55.4	50.0	70	44	5.6	.17	.03	3	4,425
Chipinga	898.3	...	76	47	65.9	51.7	58.8	...	57.0	54.4	86	53	6.2	3.35	.41	18	3,684
Enkeldoorn	862.4	...	76	42	66.7	46.4	56.6	57.4	54.3	50.7	80	48	6.0	.09	.03	2	4,787
Fort Victoria	901.7	900.7	79	41	68.0	47.1	57.6	55.7	56.0	52.6	80	50	5.2	.39	.07	6	3,570
Gwaai Siding	909.9	...	83	36	75.9	44.4	60.1	...	59.8	52.4	61	46	2.7	...	...	...	3,277
Gwanda	912.7	...	79	38	69.8	48.1	58.9	...	56.9	52.5	75	49	4.3	.23	.06	4	3,228
Gwelo	867.1	...	74	39	66.5	47.3	56.9	57.1	54.2	50.7	77	48	5.2	.19	.02	3	4,627
Hartley	891.4	...	80	40	73.5	47.0	60.2	59.0	57.7	52.2	69	48	2.9	.07	...	4	3,878
Inyanga	840.2	...	73	39	64.3	46.6	55.5	...	56.0	49.4	63	43	3.3	.52	.05	7	5,513
Marandellas	841.7	...	71	41	63.9	45.9	54.9	...	53.5	49.5	77	47	6.6	.40	.06	6	5,450
Miami	883.5	...	78	45	72.0	49.0	60.5	...	58.7	53.7	72	50	2.5	1.11	.02	4	4,077
Mount Darwin ...	912.7	...	81	42	75.5	49.5	62.5	...	62.7	56.0	66	52	3.2	.30	.03	2	3,178
Mount Nuza	805.2	...	62	36	52.7	41.9	47.3	...	46.8	45.2	90	44	6.6	3.55	...	16	6,667
Mtoko	881.9	...	78	45	71.9	49.9	60.9	...	59.7	54.0	69	49	2.1	.27	...	5	4,140
New Year's Gift...	...	...	82	47	70.8	53.0	61.9	...	58.3	55.1	83	53	...	1.34	.23	14	2,690
Nuanetsi	970.5	...	85	40	75.2	50.0	62.6	...	62.4	56.9	71	53	5.2	.17	.05	3	1,650
Plumtree	869.3	...	75	43	68.1	49.1	58.6	...	56.5	50.3	66	45	3.8	...	...	...	4,549
Que Que	887.5	...	78	42	71.4	48.3	59.9	...	58.5	53.0	70	49	3.5	.07	...	1	3,998
Rusape...	867.2	...	74	39	65.5	45.9	55.7	...	54.2	51.3	83	49	6.6	1.48	.11	11	4,646
Salisbury	859.1	858.8	76	40	68.9	47.1	58.0	57.1	57.0	51.5	69	47	4.1	.28	.05	9	4,885
Shabani	914.2	...	80	46	68.9	52.3	60.6	...	57.1	53.3	79	50	6.6	.51	.11	8	3,192
Sinoia	893.0	...	80	37	74.1	45.5	59.8	...	59.8	53.3	65	48	2.6	.07	.02	3	3,793
Sipililo	890.1	...	77	44	72.5	49.8	61.1	...	60.6	53.7	64	48	2.1	.20	.02	3	3,875
Umtali...	898.6	897.9	77	46	69.8	51.1	60.4	59.9	58.4	55.1	82	53	5.6	.77	.21	10	3,670
Wankie	932.9	...	85	51	79.5	57.4	68.5	...	62.9	53.4	53	45	1.8	...	...	...	2,566

Farming Calendar.

AUGUST.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal*. Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and,

if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farm-yard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillers. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1¼ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage,, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses. etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know. are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible. and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

SEPTEMBER.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cynaide—both requiring very careful handling. If it is wanted to increase the âpiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during Septémber usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on every young fruit. A useful spray against black aphis and thrip is the following:—Nictone, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenuous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuce, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

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No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

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No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwtring, Agriculturist.

6o. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C,T.A.

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No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

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REPORTS ON CROP EXPERIMENTS.

No. 649. Annual Report of Experiments, 1925-26, Agricultural Erperiment Station, Salisbury, by H. C. Arnold, Manager.

No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

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TOBACCO.

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LIVE STOCK.

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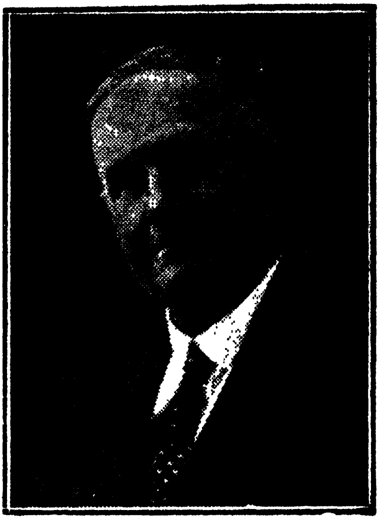
Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Foot and Mouth Disease.—At the beginning of August Dr. Gilles de Kock, the Acting Director of Veterinary Services of the Union, visited the Nuanetsi Ranch to enquire into the recent outbreak of Foot and Mouth Disease. This visit was made at the request of this Government, and the friendly co-operation of the Union Government in this matter is greatly appreciated. The Chief Veterinary Surgeon, the Director of Veterinary Research and Veterinary Officers Huston and Myhill, met Dr. de Kock at Nuanetsi and the outbreak was discussed in great detail. From this enquiry it appears to be probable that the present outbreak is a fresh introduction, but a series of experiments have been suggested to prove this beyond doubt.



C. S. Jobling.—It is with deep regret that we have to record the death of the Hon. C. S. Jobling, Minister of Agriculture, from pneumonia, on Tuesday, August 14th, at Salisbury. Born in Northumberland in 1877, of farming stock, he emigrated to the Transvaal at the age of sixteen and has spent the last forty years in Southern Rhodesia. The last thirty years have been devoted to farming in the Umguza Valley. During this time he proved his ability as a practical farmer and also as a leader of thought on agricultural matters in the country. He established the first pedigree herd of Hereford cattle in the country and, on several occasions won the highest prizes offered in the country. He was among the first Rhodesian growers of a number of crops, including maize and tobacco, and his success in every farming undertaking placed him in the front rank of the Colony's farmers. He was elected President of the Rhodesia Agricultural Union for three years in succession and held the highest office in every farmers' organisation in the Colony. His outstanding ability was soon recognised and he has served on every Commission of importance appointed to enquire into agricultural matters in the country. As Minister of Agriculture, the post he has held for less than a year, he has demonstrated the fact that his energy, his keen desire to help the farmers of the country, and his determination to overcome the difficulties of the farmers have never slackened. He was intensely dissatisfied with temporary measures and devoted his whole time to discussing the problems from every point of view in an attempt to discover permanent means of securing stability for the European farmers of the country. His death has deprived the Colony of a real friend, and, in the words of the Prime Minister "A Great Englishman and a True Rhodesian." From the Department of Agriculture's point of view we miss Mr. Jobling not only as a most able Minister but as a friend it will be difficult to replace.

Tobacco for the Union Markets.—Information has been received from the Union Government that the restrictions previously considered necessary whereby mechanical transport was insisted upon for tobacco have been withdrawn. The only restrictions now in force insist upon the tobacco having been grown at not less than 150 miles from the Foot and Mouth Disease infected area, that the hessian and packing must be new material and that the conditions of our own Tobacco Pest Suppression Act are complied with.

Appointment of Assistant Dairy Officer.—Mr. R. E. Nicol, the official milk recorder, has been appointed as Assistant Dairy Officer in the Department and will be stationed at Gwelo from the first of October if his present post can be filled by that date. The manner in which he has conducted his duties as a milk recorder has won the esteem of a large number of farmers, and it is certain that his new appointment will be welcomed by the Midland dairy farmers.

Rhodes Matopo Estate and School of Agriculture.—Owing to the resignation of Dr. D. G. Haylett, Mr. C. A. Murray, M.Sc. Agric., has now been appointed as Senior Animal Husbandry Officer in Charge of the Rhodes Matopo Estate and School of Agriculture.

Export of Chilled Beef.—Arrangements have now been concluded which provide for the export of chilled beef to Great Britain until the end of the present year. The quota allowed between July and December, 1934, has been fixed at 87,000 hundredweights, and the first consignment under this arrangement, 2,300 quarters, left Cape Town on the Balmoral Castle on August 24th.

Pretoria Locust Conference.—We learn from the *Farmers' Weekly* that the Locust Conference held in Pretoria at the beginning of last month, was so successful that full co-operation between all the Southern African territories is almost assured in the near future. The Chief Entomologist of this

Department attended, and there were official representatives from all the Departments concerned. The Conference adopted a number of resolutions which, though they must be submitted to the Governments concerned, for consideration, before they can be published, may be said to embody the principle of joint action for their effectiveness.

The Conference, it is felt, also did much good in bringing home to all delegates the gravity of the present invasion.

Entomologists and other experts in describing the extent of the invasion in the Belgian Congo, Angola and the southern portion of Portuguese East Africa, spoke of the infestation in terms of hundreds of square miles. They also referred to the red locust's dislike to the high veld areas, and to the increasing gravity of the brown locust menace to these areas, showing that no single part of South Africa is not threatened with very serious invasion in the immediate future.

The method of locust destruction which most impressed the delegates was the spraying of poison powder from an aeroplane. A demonstration was given during the course of the week, and this showed that under favourable conditions an aeroplane discharging poison effectively covers a space 400 yards wide; thus in an hour this weapon of offence can, as one delegate put it, "do more destruction than 100 men working for a week," particularly in the uninhabited areas in the north, for which it is chiefly designed.

Wood for Paper Pulp.—The following letter has been received from Capt. J. M. Moubray, Chipoli:—I see in the last number of the *Journal* that a log of each of two kinds of pine and one of cypress was sent Home to have its value as a paper making material tested. It may be of interest to you to know that about ten years ago I sent Home one ton of Eucalyptus to the Imperial Paper Mills at Tilbury (Harmsworth's) to be tested for the same purpose. The logs were from six to eight year old Eucalyptus Saligna. The report was to the effect that if the Eucalyptus pulp was mixed with spruce pulp in the proportion, if I remember rightly, of 80 per cent. of the former and 20 per cent. of the latter, a good coarse paper could be made suitable for many purposes and actually

better for some than a paper of 100 per cent. spruce. The acreage of timber to support a mill on a commercial scale was far greater than the total plantings in Rhodesia at that date. The Imperial Paper Mills were of opinion that the climate of Rhodesia was not suitable for paper making and that, if anything was to be done, the wood would have to be pulped in Rhodesia and the pulp shipped to be turned into paper at Home. If paper making is ever contemplated, the use of Eucalyptus as a raw material would be far more suitable than either pine or cypress; in the first place, it can be grown practically all over the country, whereas a commercial growth of the two former is limited to the Eastern border. When I was in Newfoundland years ago Harmsworths used to ship pulp as well as paper from their Grand Falls paper mills, but the distance from the mills to tidewater was not great. Again, all their raw material in the form of logs was water-borne to the mills; in Rhodesia it would have to be railed if the mills were situated at any distance from the forests.

Salisbury Agricultural Experiment Station

ANNUAL REPORT, 1932-33.

By H. C. Arnold, Manager.

The rainfall of 27.56 inches which fell during the season under review was approximately 4½ inches below the average for the station, and although it amounts to 1½ inches more than the previous season's total, its incidence was so irregular and the temperatures were so low during December and January that the crops were adversely affected. The yields in most cases were about one half of those of the previous season.

ANALYSIS OF RAINFALL, 1932-33.

Month.	No. of rain days.	Total for for month.	No. of rains over ¼ inch.	Total to end of month.	Periods exceeding one week without rain.
October	1	.05	—	.05	Oct. 30th to Nov. 9th.
November	8	2.58	3	2.63	Nov. 12th to Nov. 25th
December	22	7.32	12	9.95	Nil.
January	21	9.63	14	19.58	Jan. 27th to
February	11	4.80	7	24.38	Feb. 10th.
March	4	.39	1	24.77	Mar. 1st to Mar. 14th
April	6	2.87	2	27.64	& Mar 20th to Apr 4th
	73	27.64	39		

The light showers which fell during the month of March were of little value to the maize crop, and it is seen that of the 24.38 inches which were effective, 17 inches fell during the months of December and January. The excessive rains at that period retarded the growth of the crops, but the droughty conditions which followed proved equally unfavourable. The precipitation of nearly three inches of rain during April is unusual, and the mid-season's sowings of Sunn-hemp appear to have benefited very considerably, as the yields of seed were the heaviest reaped for several years.

The results of experiments conducted at this station since 1919-20 are available for reference in bulletin form, and to facilitate comparison this report is drawn up on similar lines to previous ones.

The activities of the station were mainly concerned with the continuance of work begun in previous seasons, but three new lines of investigation were commenced, namely:—

(1) Ground nut variety and espacement trials.
(2) Fertiliser trials for seed production in Sunn-hemp.
(3) Effect of lime on nodule formation on the roots of legume.

CROP ROTATION EXPERIMENTS.

First Series, 1913-32.

Maize Yields in Bags per Acre.

System of Cropping.	1932-33 rainfall 27.64 inches.	1931-32 rainfall 26.62 inches.	1930-31 rainfall 31.47 inches.	1929-30 rainfall 23.46 inches.	1928-29 rainfall 31.62 inches.	1927-28 rainfall 26 63 inches.	Average yields.
*A1.—Maize continuous green manured, plus 250 lbs. per acre bone meal and 19 per cent. supers in 1928-29 (18th year)	Green manure ploughed in	9.60	12.60	15.88	Green manure ploughed under.	1.90	
*A2.—Maize continuous, 250lbs. per acre bone and supers to the maize in 1928-29 (18th year)	3.53	10 92	2.99	11.44	6.20		
†B.—Alternate maize and bare summer fallow; no manure or fertiliser	2.34	10 02	1.95	6.43	5.65	8 15	9.62
C.—Three - course rotations: maize, dolichos beans (reaped), oats; no manure or fertiliser	4.90	11.1	11.70	11.36	12 00	12.15	14.03
D.—Four-course rotation: maize, (plus 6 tons dung per acre), oats, dolichos beas (reaped), maize; average of 2 maize plots	14.21	16.33	14.93	15 79	19.00	17.45	..
Maize (no manure direct)	14.40	14 80	14.95	13 25	21.35	14.10	17.87 (17 years)
Maize (dunged plots)...	14.02	17.85	14.90	18.33	16.65	20.80	18.63

***Note.**—Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields had gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosprate at the rate of 250 lbs. per acre at the beginning of 1928-29 season. One-half of the plot was then planted to maize while the other half was sown to a mixture of Sunn-hemp and velvet beans, which were subsequently ploughed in.

†In 1929-30 this system was amended from "Alternate Maize and Bare Summer Fallow" to "Alternate Maize and Dolichos Beans for Hay."

System A.—During the season under review it was decided to repeat the treatment given in season 1928-29 when the whole area was dressed with bone and superphosphate at the rate of 250 lbs. per acre. Plot A.1 was then sown to Sunn-hemp to be ploughed under for green manure, while Plot A.2 was sown to maize for the twentieth year in succession. The yield of 3.53 bags of maize per acre obtained after using a dressing of fertiliser costing 18s. 6d. per acre is seen to be uneconomic, but it is probable that the unfavourable climatic conditions in addition to the lack of humus prevented the plants from making use of the fertiliser.

System B.—The yields here reveal the fact that the inclusion of dolichos beans in this system has had very little beneficial effect on the maize crop as yet. This is probably due to the beans having been subjected to insect attacks each year, which have prevented them from making normal growth. It is proposed to substitute velvet beans and soya beans for dolichos in future. It should be mentioned, however, that it has been found that the attacks of the various insect pests of the crops grown on such a small isolated area as this station are usually much more severe each year than is the normal experience on the average farm throughout the Colony. The low yields reaped in this system support those of System A. in showing how much the farmer is dependent on climatic conditions, when the fertility of his land has been reduced by repeated cropping.

System C.—The harmful effects of continuous cropping without compensation in some form or other for the loss of fertility are now commencing to show in this system. For several years the yield of maize in this rotation has exceeded eleven bags per acre, but owing to the unfavourable season the yield this year is less than fifty per cent. of the average yield for the previous three years. Nevertheless, it is double that obtained in System B. and nearly 40% more than that of System A. in spite of the expenditure incurred for fertiliser in the latter case.

System D.—The beneficial effect of a small application of farmyard manure is plainly shown in this rotation. The dressing is equal to 1½ tons per acre per annum, but its stabilising effect on the yields is very remarkable. It indicates

that the farmer who plants half of his cultivated lands to fodder crops to feed his cattle can maintain the fertility of his land at a fairly high level by returning his farmyard manure to his cultivated land. The comparatively high yield of the plot which received the manure three years previously shows that the intervening crops of oats and beans have reduced the fertility ot the soil by a comparatively small amount, and that it has not been seriously diminished through leaching by the rains.

Comparison of the yields obtained during the season under review with those of previous seasons reveals in a very striking manner the effect which seasonal changes exert on the productivity of soil which lacks humus and has been sown to the same crop for a number of years. Conversely these returns also prove that by practising a balanced rotational system of cropping, while maintaining the phosphate and humus content of the soil, the farmer may acquire comparative immunity from the effects of unfavourable seasons.

SECOND SERIES OF CROP ROTATIONS.

These rotations were laid down in 1919-20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt mixed farming. The series included two plots, A. and F., on which maize was grown continuously for ten years without manure or fertiliser to serve as checks on the results from the rotations. For this purpose the cropping of Plot A. continues as in the past, but on Plot F., commencing season 1929-30, fertiliser is applied in alternate years. The fertiliser treatment given to this plot is the same in quantity and quality as that accorded in rotational System II, but green manuring is entirely omitted.

Plot A: System E.—Maize continuous without manure or fertiliser:—

Seasons and Yields of Maize in Bags per Acre.

1932-33.	1931-32.	1930-31.	1929-30.	1928-29.	1927-28.	Average over 14 years.
1.74	11.60	2.33	7.85	7.65	6.5	10.71

The effect of seasonal variations on crop production when the soil lacks humus is strikingly illustrated by the yields of

this plot. Last season's yield was the highest obtained for several years, while that for the season under review is the lowest ever recorded for this plot.

Plots B to E: System F.—Three-quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, receives eight tons of farm manure per acre, and commencing on Plot E in 1929-30, the section which grew Sudan grass the previous season receives 200 lbs. per acre of superphosphate (19 per cent. P_2O_5).

Maize Yields in Bags per Acre.

	1932-33.	1931-32.	1930-31.	1929-30.	1928-29.	1919-20.	Average 1920-33.
Plot B	9.72	22.65*	9.10†	Sudan g.	14.55	26.0	17.84
Plot C	10.75*	19.33†	Sudan g.	13.33	10.15*	23.7	15.32
Plot D	11.05†	Sudan g.	9.10	15.78*	9.55	Sudan g.	16.42
Plot E	Sudan g.	19.23	13.42*	13.90†	Sudan g.	24.6	16.65
Average	10.51	20.41	10.54	14.34	11.42	24.7	16.56

* Indicates the application of farmyard manure.
† Indicates the application of 200 lbs. per acre superphosphate.

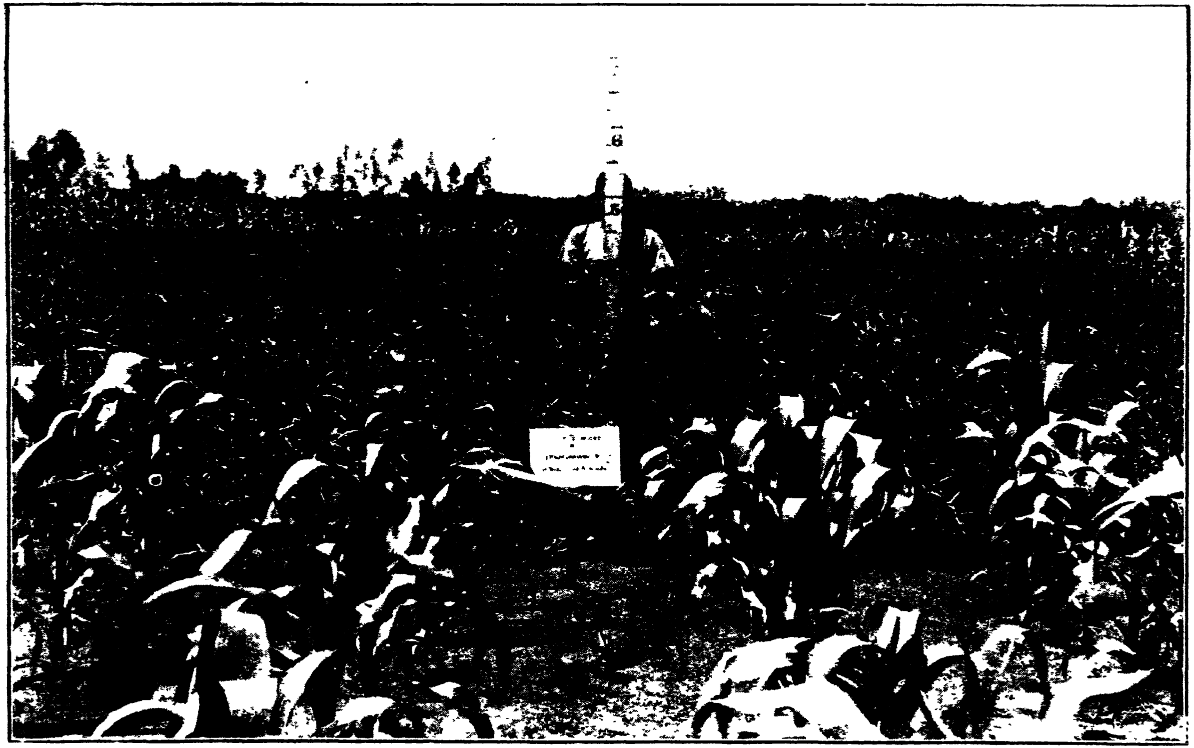
In this system the maize crop occupies the lands almost continuously and the effect is revealed by the fluctuating yields which are seen to be subject to seasonal variations to a much larger degree than those of System D, in which the land carries only two crops of maize in the four-year period. The average yield of these plots for this season is seen to be approximately one half of that of the previous season, and considerably less than one half of the amount obtained in the season 1919-20 when the experiment commenced.

Plot F: System G.—Maize continuous. No manure or fertiliser during the first ten years. Commencing season 1929-30, fertiliser consisting of one-third bone meal and two-thirds superphosphate at the rate of 200 lbs. per acre is applied every alternate year.

Seasons and Yields of Maize in Bags per Acre.

1932-33.	1931-32.	1930-31.	1929-30.	1928-29.	1919-20	Average over 14 years.
5.33	21.08*	7.03	6.38*	6.1	23.3	11.63

* Indicates the application of 200 lbs. per acre fertiliser.



Crop Rotation, System A.—Maize for the twentieth year in succession. In spite of the dressing of 250 lbs. of phosphate the maize did not thrive as well as the Sunn-hemp on the other part of the plot

Fertiliser of the same kind and in the same quantities is applied to this plot as in System II below, but in this case no humus, either in the form of farmyard or green manure, is given. In this way information regarding the practicability or otherwise of profitable maize production on soil lacking humus though amply supplied with phosphates should be provided.

This season's yield is the lowest ever recorded from this plot, with the exception of that for the season 1927-28, which was before any fertiliser had been applied. As this follows the very high yield of 21 bags, it seems to indicate that applications of phosphate to land somewhat deficient in humus may increase the yield very considerably in seasons in which the climatic conditions are favourable to plant growth, and that, in such seasons the phosphate is almost entirely absorbed.

Plots G to K: System H.—Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of this experiment until 1928-29 this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. of 19 per cent. superphosphate per acre, which should enable it to make better use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop, that immediately in front of the green crop, receives 200 lbs. per acre of a mixture of bone meal and superphosphate. Under the revised system it is anticipated that heavier green manure crops will be available for ploughing under, and this, combined with the additional application of artificials, should result in a satisfactory maintenance of soil fertility.

Maize Yields in Bags per Acre.

	1932-33.	1931-32.	1930-31.	1929-30.	1928-29.	1919-20.	Average 1920-33.
Plot G	5.94*	12.75	16.80*	Beans	8.75	23.10*	14.78
Plot H	9.32	22.45*	Beans	10.70*	9.00	23.00	15.62
Plot J	10.65*	Beans	6.10*	7.57	17.50	Beans	14.63
Plot K	Beans	16.50*	7.53	16.00*	Beans	19.20	14.71
Average	8.63	17.23*	10.14	11.42	11.75	21.70	14.94

* Denotes application of fertiliser.

In spite of the application of fertiliser to Plot G the yield is little more than that obtained on Plot F (System G) noted above, which receives fertiliser only with no green manure at any time. In view of this, it would seem that the benefit derived from the green manure applied three years previously was exhausted by the two previous crops. It appears, therefore, that farmers may find it more profitable to green manure every third season when maize is grown repeatedly. Experiments to investigate this point more fully have been commenced.

The yields obtained from the plots in this rotation are somewhat lower than those in System F. This indicates that a dressing of 8 tons per acre of farmyard manure is more effective than an application of green manure and 200 lbs. of superphosphate in maintaining the fertility of the soil.

NEW ROTATIONAL SYSTEMS.

Earlier experiments having shown the beneficial effects which follow the inclusion of different kinds of crops in the rotation, in addition to applications of phosphatic fertilisers and the maintenance of the humus content of the soil, two new rotational systems in which these principles are combined, were commenced in the season 1926-27. These have been designated Systems M and O respectively. In the former system the land is green manured and fertilised once during a period of four years, and is cropped to maize twice and either ground nuts or sunflowers once during that period. In the second system the humus is supplied by 8 tons per acre of farmyard manure every fourth year, and this is supplemented by a dressing of 200 lbs. per acre of bone and superphosphate in the second season after the manurial application. Maize is

sown on the land which is manured or fertilised, and sweet potatoes and hay crops are grown in the intervening seasons. System M is suitable for farmers whose supply of farmyard manure is limited, and those who wish to dispose of their crops off the farm, while System O is suited to owners of live-stock, to which the crops can be fed, though it provides for the alternative course of marketing a large part of the crop direct should it be found more convenient or remunerative to do so.

System M.—This is a four-course rotation in which the sequence of the crops is:—Maize; ground nuts and sunflowers; maize+200 lbs. per acre of bone and superphosphate; green-manure. Hence half of the land is sown to maize, one-eighth to sunflowers, and the quarter which received the fertiliser in the previous season is green-manured. In the following tabulation the yields of the various plots are expressed in bags per acre, a "bag" of maize being 200 lbs. and a bag of ground nuts 75 lbs.

Seasons and Yields in Bags per Acre.

	1932-33	1931-32	1930-31	1929-30	1928-29	1927-28	1926-27	Average maize yield. 1926-33
Plot A .	N.14.0	17.20	G.M.	*9 47	N 13.0	10.30	G.M.	12.32
Plot B..	10.15	G.M.	*6.25	N 23 0	17.55	G.M.	*15.15	12.28
Plot C. .	G.M.	*15.05	N.6.0	14.67	G.M.	*12.25	N.21.0	13.99
Plot D... ..	*8.05	N.11.0	13.38	G.M.	*13 60	N.6.0	12.60	11.91
Average maize yield . .	9.10	16.13	9.82	12.07	15.58	11.28	13 88	12.62

* Denotes the application of fertiliser.
G.M. Denotes the application of green manure.
N. Denotes the position of the ground nuts in the rotation.

During the four-year period 1930-33 the average yield of maize per acre was 11.78 bags, which almost equals the 11.86 bags obtained in System H over the same period, although in the latter system twice as much fertiliser was used. Assuming that the ground nuts and sunflowers were as profitable as the maize, these results indicate that the introduction of those crops in the rotation made it possible to produce the maize, with only half as much fertiliser as the maize-only system required.

System N.—Maize continuously. Commencing in the season 1931-32, 100 lbs. per acre of bone and superphosphate is applied to this land in alternate years, and in this way fertiliser of the same quality and quantity as that supplied to System M is provided here, but no green manure is given.

Seasons and Yields of Maize in Bags per Acre.

1932-33.	1931-32.	1930-31.	1929-30.	1928-29.	1927-28	1926-27.
4.30	12.55	4.0	5.50	9.05	8.25	14.70

System O.—In this system the humus content of the land is maintained by the application of 8 tons per acre of farmyard manure, and 200 lbs. per acre of bone and superphosphate during every period of four years. The order or rotation is:—Maize fertilised; sweet potatoes; maize with kraal manure; hay crops. This system is typical of a rotation suitable for dairymen or others who can make use of their crops by feeding them to stock. In practice it might be found more profitable to leave the sweet potatoes down for two years, and in that way secure a volunteer crop at a low cost. This might involve some alteration in the plan of the rotation. Further, many farmers will prefer to grow pumpkins and majordas as well as sweet potatoes to fill their requirements for succulent feed. Similarly, alterations would probably be made with the other crops, to suit the individual farmer's conditions, but if the principles are adhered to, the results may be expected to be approximately the same.

In the tabulation below are shown the acre-yields of maize in bags of 200 lbs. and of bean hay and sweet potatoes in tons.

Seasons and Yields in Bags (or Tons) per Acre.

	1932-33	1931-32	1930-31	1929-30	1928-29	1927-28	1926-27	Average maize yields. 1926-33
Plot F... ..	P.3.6	*18.55	H.1.5	†15.1	P.71	*17.0	H.1.1	16.88
Plot G	*9.10	H.1.2	†16.78	P.4.8	*18.3	H.1.5	†19.65	15.96
Plot H... ..	H.0.56	†20.25	P.7.4	*13.5	H.2.3	†18.85	P.6.1	17.53
Plot J... ...	*9.95	P.12.4	*14.03	H.1.2	†16.75	P.8.5	*16.45	14.29
Average of maize plots	9.53	19.40	15.41	14.3	17.53	17.93	18.05	16.17

* Denotes the application of fertiliser.
† Denotes the application of farmyard manure.
P. Denotes the position of the sweet potatoes in the rotation.
H. Denotes the position of the bean hay crop.

This system is comparable with System F in that the same amounts of farmyard manure and fertiliser are applied in both cases, but in the rotation under consideration a wider range of crops is employed. In the four-year period 1930-33 the average acre yield of maize in System F was 13.95 bags, but in System O it was 14.66 bags during that period. In addition to the maize, the sweet potatoes yielded an average of 7.0 tons of tubers, whose value for feeding purposes would approximate that of 17 bags of maize. Further, the sweet potato vines and the legume hay would be of much greater value than the Sudan grass which is grown in System F.

It is seen, therefore, that the results obtained from the four rotational system C, D, M and O support those of similar trials conducted in other countries by showing that larger returns can be obtained from a system which includes a number of crops which differ from one another in their food requirements, and habit of growth, than is possible when a single crop is grown.

Method of Application of Fertiliser Trials.—These investigations were undertaken at the request of the Maize Association with the object of ascertaining whether the manner in which fertiliser is applied to the land is likely to affect the yield of the maize crop. Fertiliser is applied in four different ways, namely:—

(1) Broadcast shortly before planting time and harrowed in.

(2) Broadcast during winter and ploughed in.

(3) In holes in check rows shortly before the seed is planted.

(4) In drills at the time of sowing the seed.

Previous trials have indicated that in the first season after the application of fertiliser the various methods were equally effective, with the exception of method No. 1, in which the fertiliser is broadcast shortly before the seed is planted and harrowed in, to incorporate it with the surface soil. That this

method should prove less efficacious than the others is unfortunate, because under general farm conditions it is the least expensive and most convenient method of applying the fertiliser. Other experiments cited indicate that when applied phosphates are not absorbed during the first season, they may be utilised by a later crop, in which case when regular application of fertiliser is practised, the temporary loss of a small proportion may not prove serious.

To investigate this aspect of the problem it was decided to re-arrange the plan and in future to practise each method of applying fertiliser in its own particular group of plots over a period of years, when, if after the first year or two the yield of the "harrowed in" plots equals those of the other methods, this method of applying the fertiliser will have been shown to be the most economical, in spite of the temporary loss of a bag or two of maize in the first season.

In the new trials each method of applying the fertiliser is replicated five times, and superphosphate is used at the rate of 150 lbs. per acre over the whole series of plots.

The following table records the yields of maize in lbs. per 1-20 of an acre plot, reaped during the two seasons 1931-32 and 1932-33:—

METHOD OF APPLYING FERTILISER.

Lbs. per Plot of 1-20 of an Acre.

Harrowed in.		Ploughed in.		Holes.		Drills.	
1931-32.	1932-33.	1931-32.	1932-33.	1931-32.	1932-33.	1931-32.	1932-33.
176	70	209	109	189	74	199	101
170	61	209	103	181	96	171	73
166	64	210	83	161	30	209	128
137	29	183	56	188	62	166	55
174	77	175	49	183	71	158	58
823	301	986	400	902	333	903	415

This season's results support those of the previous trials. In the season 1931-32 the yield of the "harrowed in" plots was 88% of the average yield from the remaining plots, and during the season under review the yield following that method of applying the fertiliser was only 79% of the average yield for the other three methods. Therefore it does not appear that the residue of available fertiliser was greater on the "harrowed in" plots than on the others. This experiment is being continued.

The Relative Value of Sunn-hemp and Sunflower for Green Manure.—The scarcity and high cost of the seed of Sunn-hemp has compelled farmers to employ an alternative crop for green manure, though it is generally thought that the Sunn-hemp is superior to all others for that purpose. Other leguminous crops, such as velvet and dolichos beans, are sometimes used, but owing to their trailing habit of growth they are more difficult to plough under than upright growing crops and require several cultivations to control weeds. Among the non-legumes, sunflowers possess considerable merit, and they are often used, either alone or mixed with the Sunn-hemp. For the purpose of ascertaining the relative value of Sunn-hemp and sunflower for use as green manure, trials were commenced in 1928-29, when duplicate plots were sown to the two crops, but the difference between the yields of these plots was so small that both crops appeared to be equally valuable for use as green manure.

In the season 1930-31 a new series of trials was commenced in which the crops were sown separately, and also mixed in equal proportions by weight of seed. Each treatment was replicated nine times, and all the plots were sown at the rate of 45 lbs. of seed per acre. Very dense stands were thus secured, and the crops were ploughed under between 20th February, 1931, at which time both were beginning to form their first seed. The whole area was planted to maize during the two following seasons, with the results as shown in the following table, in which the yield of each 1/27th of an acre plot is given in lbs.

SUNN-HEMP *versus* SUNFLOWER FOR GREEN MANURE.

Yield of Maize in lbs. per 1-27 of an Acre.

	After Sunn-hemp ploughed under. 1931-32.	1932-33.	Sunflower ploughed under. 1931-32.	1932-33.	After two crops mixed ploughed under. 1931-32.	1932-33.
	181	108	160	102	152	112
	183	93	138	93	162	76
	148	86	155	69	163	87
	177	91	151	91	171	85
	153	96	157	74	157	64
	164	78	135	56	170	88
	202	89	166	93	174	78
	159	82	156	68	149	75
	110	69	120	79	111	84
Totals 9 plots	1,477	792	1,338	725	1,409	749
Yields in bags per acre (two seasons) .	34.04		30.95		32.37	

In this trial we have the evidence of 27 plots which have been cropped for two successive seasons, and the results indicate a decidedly heavier yield where the pure stand of Sunn-hemp was ploughed under. There was a proportionately smaller increase in favour of the mixed crops, but under field conditions it may be found more economical to mix the two crops, because owing to their dissimilarity each is immune to the diseases and insect pests of the other to a large extent. Hence if one of the crops fails, the other will take its place and a useful crop for ploughing under will be obtained in spite of the mishap to the one crop.

Comparison of the Effect on Succeeding Crops of Maize of Ploughing Under Green Sunn-hemp versus Burning the Mature Crop of Sunn-hemp on the Land.—A number of farmers in the Arcturus District have persistently reported that their yields of maize following the burning of mature crops of Sunn-hemp

Seed-bearing branches of "Somerset" Sunn-hemp. The seed production of this variety exceeds that of the common kind by 100 per cent. and only half the quantity of seed per acre is required when sowing for green-manuring or for seed.

are as large, or even larger, than those of crops on adjoining land where the Sunn-hemp had been ploughed under for green manure in the usual way. As the practice of green manuring has been generally adopted during recent years, and the benefits derived from it are acknowledged by an overwhelming majority of farmers whose climatic and soil conditions vary widely, these reports occasioned no little surprise. Various reasons for such a result have been put forward, such as that the burning may cause the temporary increase in nitrogen-fixing bacteria in the soil as shown by Russell and others at Rothamsted, or liberate essential nutrients which would otherwise remain unavailable to succeeding crops, or that the potash in the ash of the burnt crop may supply a shortage in the soil and so stimulate the growth of the young maize and enable it to maintain its lead over the crop on the land on which the green material had been ploughed in.

Investigations were commenced in the season 1930-31 when a crop of Sunn-hemp was treated in three different ways, namely:—

(*a*) ploughed under for green manure when the first pods formed;

(*b*) mature crop burned on the land;

(*c*) ash returned to the land after the mature stalks had been burned elsewhere, to avoid the partial sterilising effect (if any) of burning the crop on the land.

Each method of treating the Sunn-hemp was replicated ten times.

In the season following this treatment, when the maize plants were about one month old, those on the (*a*) and (*b*) plots were more vigorous than those growing on the plots which received ash only, but two weeks later the plants on the land which had been green-manured were slightly taller and more robust than those on the other plots.

The yields of the plots during the seasons 1931-32 and [illegible]-33 are tabulated below:—

Yields of Maize in lbs. per Plot of 1/30th Acre.

	Sunn-hemp. Ash only. 1931-32.	1932-33.	Sunn-hamp. Burned on the land. 1931-32.	1932-33.	Sunn-hemp. Ploughed under for green manure. 1931-32.	1932-33.
	160	87	166	93	151	92
	145	79	161	64	170	77
	164	82	166	99	174	87
	173	76	157	92	191	96
	159	110	166	90	171	109
	161	78	142	72	182	79
	159	60	158	66	140	66
	143	44	134	62	135	49
	136	55	116	35	123	41
	111	51	135	50	151	61
Seasonal totals	1,511	722	1,501	723	1,588	757
Treatment totals 2 seasons .	2,233		2,224		2,345	

These returns indicate a slight increase of yield in favour of ploughing under the green Sunn-hemp crop, and fail to show any permanent benefit from the partial sterilising effect of burning the mature crop on the land. Further, it will usually be found more economical to plough the green crop under during the summer months than to delay operations and incur the expense of cutting and burning the crop before ploughing the land later in the season. Only when the weather is so unfavourable as to make it impossible to plough under the green crop without injuring the texture of the land, would the alternative course of cutting and burning the crop appear to be justified.

A similar stimulation of the maize is to be noted where heaps of maize trash are burnt on the fields and the dark green of the maize indicates an increased nitrogen supply due, almost certainly, to the partial sterilisation of the soil, bringing about an increased activity of the nitrogen-fixing bacteria.

(*To be continued.*)

Analyses of Rhodesian Foodstuffs.

By The Division of Chemistry.

A considerable amount of data is available in such valuable textbooks as Henry & Morrison, Hall, Wood, Kellner, and those of many other authors regarding the chemical composition of animal foodstuffs, but these analyses refer to products that have been grown in countries other than our own.

During past years many Rhodesian grasses, legumes, cereals, and other common animal foodstuffs produced and fed in the Colony have been analysed for various purposes in the chemical laboratories of the Department of Agriculture, and it has long been felt that the analytical data available put in the form of a bulletin might be of value to farmers and others.

The increased attention being paid to the feeding of cattle makes the demand for a series of analyses of our commoner foodstuffs more urgent, and it has therefore been decided to issue the following tables, as it is felt that the information contained therein will be of value in assisting farmers in compiling suitable balanced rations for stock from the foodstuffs available on their farms.

In most textbooks giving the analyses and nutritive ratios of foodstuffs the latter are usually computed from the digestible and not from the crude nutrients.

No digestibility trials on cattle have ever been carried out in this Colony, therefore no data are available to show the digestibility of any of our common foodstuffs.

In the circumstances, the nutritive ratios shown in the last column of these tables have been calculated on the crude nutrients, and, although not in accordance with the usual method adopted, it is considered that they will prove useful in classifying foodstuffs, as they show the relative proportion of proteins to carbohydrates and fats.

Calculations.—The Protein Factor.—The protein content of foodstuffs is ascertained by determining the nitrogen content and multiplying this figure by the factor 6.25.

This factor is derived from the assumption that the whole of the nitrogen present in foodstuffs is in the form of protein and that all proteins contain 16 per cent. of nitrogen, *i.e.*, $\frac{100}{16}$. This figure is fairly accurate for animal proteins, but is only roughly correct for vegetable proteins, as these latter contain more nitrogen than animal proteins. Factors varying from 5.5 to 6.25 have been suggested for different vegetable proteins, but although 6.25 is too high for a number of these, this factor has been used throughout for calculating the protein content of all the foodstuffs in the following tables.

The Nutritive Ratios in these tables are calculated by adding to the percentages of carbohydrates and fibre, the percentage of fat multiplied by 2.3, and dividing the sum by the percentage of crude protein, so arranged that the numerator is unity. Thus:—

$$\text{Nutritive Ratio} = \frac{\text{Crude Protein.}}{(\text{Fat x } 2.3) + \text{Soluble Carbohydrates} + \text{Fibre.}}$$

$$= \frac{1}{\dfrac{(\text{Fat x } 2.3) + \text{Soluble Carbohydrates} + \text{Fibre.}}{\text{Crude Protein.}}}$$

PERCENTAGE COMPOSITION OF RHODESIAN FOODSTUFFS.

I.—CONCENTRATES.

(a) Grains and Seeds.

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
Ground Nut.	%	%	%	%	%	%	
Spanish Bunch—							
Entire pods	7.36	2.35	24.71	36.31	16.02	13.25	1:4.6
Husks	10.65	3.06	4.81	0.98	61.16	19.34	1:17.2
Kernels	6.36	2.14	30.79	47.10	2.23	11.38	1:4.0
Virginia Bunch—							
Entire pods	8.82	2.64	22.07	32.90	18.12	15.45	1:4.9
Husks	10.84	2.40	4.58	1.09	64.50	16.59	1:18.2
Kernels	8.15	2.73	27.94	43.57	2.56	15.06	1:4.2

(a) *Grains and Seeds.*—(Continued.)

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Linseed grain (white (flowering)	6.97	3 84	22.75	30.23	5 67	30.54	1:4.6
Maize (Dent)	7.0	1.3	9.4	4.5	1.9	75.9	1:9.1
Maize (Flint)	7.4	1.8	10.9	5.3	1.9	72.7	1:7.8
Maize (Hickory King) ...	9.8	1.2	9.3	4.4	1.4	73.9	1:9.2
Maize (Salisbury White)	10.2	1.4	9.3	4.7	1 5	72 9	1:9.2
Nyouti	9.42	2.18	11.37	4.31	1 57	71.15	1:7.3
Oats, Hull-less	11.43	2.13	21.00	7.81	2.00	55.63	1:2.8
Oats, Kherson . ..	9 51	3.90	15.31	5.32	11 26	54.70	1:5.1
Oats, Kinvarra . .	9 66	3.92	12 25	8 70	13.71	51 76	1 7 0
Panicum sp . ... (Native grass seed).	11.12	2.20	8.18	1.55	3 48	73.47	1:9.8
Pumpkin seeds ..	5.54	3 93	33.91	39.57	15.05	2 00	1:3.2
Rapoko	10 58	3.16	7.62	1.30	2.88	74.46	1:10.8
Sunflower heads . . .	10.49	5.15	12.25	12.90	24.52	34.69	1:7 3
Sunflower seed. . . (Black Sel.)	5 76	2.28	14 37	26.77	25 24	25.58	1:7.8
Sunflower seed.. . . (White Sel.)	5.54	2.61	16.63	24.86	25.99	24.37	1:6.5

(b) *Miscellaneous Concentrates.*

Coffee bran	11.9	4.3	2.0	0.2	60 3	21 3	1:41
Copra cake	4 9	4.2	13.1	33.3	8.7	35.8	1:9.2
Corn and Cob Meal . .	12.4	1.4	8.3	4.1	4.7	69 1	1:10.0
Cotton seed cake	7.3	4.9	33.6	13.3	13.4	27 6	1:2 1
Germ Meal ... ... (2 analyses).	12.1	2.8	9.1	5.3	3.6	67.2	1:9.2
Ground Nut Cake... .. .. (decorticated)	6.2	4.1	45.9	16.2	4.5	23.1	1:1.4
Hominy Chop ... . (3 analyses).	10.26	1.48	8.75	4.56	4.90	70.06	1:9.8
Locust Meal	7.06	6.84	47.47	22.91	10.81	4.91	1:1.4
Maize Alcohol Residue ...	10.1	4.3	27.8	12.1	8.8	36.9	1:2.7
Mealie Meal ... ... (3 analyses).	10.22	1.30	8.58	4.69	1.96	72.61	1:9.9
Mimosa Meal	7.06	4.15	11.25	0.92	21.18	55.44	1:7.

(*b*) *Miscellaneous Concentrates.*—(Continued.)

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Palm Kernel Cake	5.1	3.5	14.0	15.5	18.5	43.4	1:7.
"Seepu"	9.92	13.91	12.19	2.30	10.19	51.49	1:5.2
Sunflower Heads, seeds removed	11.73	11.62	8.86	3.18	18.19	46.42	1:8.1
Wheat Screenings...	8.8	7.2	11.2	2.1	13.4	57.3	1:6.7

(*c*) *Slaughter-house By-products.*

Blood Meal ... ... (2 analyses).	9.48	3.60	80.50	0.28	0.91	5.23	1:0.08
Bone Meal ... ... (2 analyses).	6.4	67.1	20.6	2.2	0.9	2.8	1:0.4
Meat Meal ... ... (3 analyses).	6.7	15.4	56.8	17.3	2.3	1.5	1:1.3

(*d*) *Leguminous Pods and Seeds.*

Acacia Albida (pods) ...	7.1	3.4	11.1	1.4	27.5	49.5	1:7.2
Acacia (Benthami beans)	6.96	3.45	12.56	4.57	9.46	63.00	1:6.6
Acacia sp (whole pods and contained seeds)	8.58	5.65	14.22	1.48	21.55	48.52	1:5.2
Albizzia amara (pods and seeds)	9.31	3.29	12.25	6.89	32.69	35.57	1:6.9
Bauhinia thonningii (pods)	6.1	3.9	6.6	3.1	23.7	56.6	1:13.2
Camelthorn pods (Acacia giraffe)...	9.36	3.29	11.37	1.61	30.98	43.39	1:6.9
Carob bean (Ceratonia siliqua) (pods without seeds)...	5.68	2.25	3.24	2.09	9.90	76.84	1:28.3
Carob bean (seed only)...	8.14	3.44	16.38	2.55	7.93	61.56	1:4.6
Carob bean (entire pod meal)	6.10	2.45	5.48	2.17	9.56	74.24	1:16.2
Cow-peas (seeds only) ...	13.9	3.4	23.4	1.8	5.9	51.6	1:2.6
Dichrostachys nutans (bean)	7.08	4.59	18.55	2.07	20.27	47.44	1:3.9
Dolichos bean	8.03	3.90	24.72	1.00	9.77	52.58	1:2.6
Lucaena glauca (pods only)	19.5	4.7	17.5	1.1	20.6	36.6	1:3.4
Madagasca Butter bean (entire pods)	9.3	3.6	11.8	1.8	26.0	47.5	1:6.6

(*d*) *Leguminous Pods and Seeds.*—(Continued.)

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Nyomo (bean)...	9.4	3.6	16.3	6.8	5.7	58.2	1:4.9
Somerset Velvet Beans (beans only)	11.0	3.1	22.9	5.1	5.7	52.2	1:3.0
Somerset Velvet Beans (beans and pods) ...	10.4	3 4	13.3	3.0	14.3	55.6	1:5.8
Swartzia Madagascariensis (whole pods and contained seeds).	8.86	2.43	5.69	1.12	21.10	60.80	1:15.
Velvet Bean (White Stingless) seed	10.18	3.54	26.94	6.13	3.11	50.10	1:2.5
Velvet Bean (White Stingless) pod without contained seeds	9.49	5.06	4.19	0.98	27.27	53.01	1:19.7
Velvet Bean (White Stingless) entire pod meal	9.87	4.21	16.89	3.85	13.78	51.40	1:4.4

II.—DRIED ROUGHAGE.

(*a*) *Hay from Grasses, etc.*

Black Turf grass (Ischaemum glaucostachyum)	13.19	9.15	9.56	1.80	32.09	34.21	1:7.2
Buffalo grass (Setaria Chevalieri)	9.40	11.16	11.25	2.06	24.87	41.26	1:6.3
Climbing Belhambra (Phytolacca octandra)	13.9	11.3	22.8	2.1	15.0	34.9	1:2.4
Common Buffel or Guinea grass (Panicum maximum)	13.11	11.74	12.38	1.49	23.13	38.15	1:5.2
Cow pea plant (complete)	13.7	8.9	15.6	2.0	21.6	38.2	1:4.0
Digitaria setivalva	11.30	10.13	11.69	2.30	24.54	40.04	1:6.0
Dryland grass (Pennisetum ciliare)	10.57	11.60	14.88	1.66	28.50	32.79	1:4.4
Gonya grass (Urochloa bulbodes)...	10.74	11.54	15.81	1.77	21.98	38.16	1:4.1
Gonya grass (Urochloa mosambicensis)...	11.53	11.36	13.06	1.32	24.71	38.02	1:5.0
Hunyani grass (Chloris gayana)	9.90	8.36	9.31	1.74	28.83	41.86	1:8.0
Kudzu vine (complete) ...	4.52	6.28	13.38	2.43	34.57	38.82	1:5.9
Kudzu vine (leaves)... ...	8.05	7.13	18.06	3.56	19.81	43.39	1:4.0
Kudzu vine (stalks)... ...	7.81	5.19	5.29	0.95	42.63	38.12	1:15.7

(*a*) *Hay from Grasses, etc.*—(Continued.)

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Limpopo grass, S.A.; Antelope grass, Rhod. (Echinochloa pyramidalis)	17.55	8.41	12.88	1.99	27.55	31.62	1:4.9
Milanje grass (Digitaria milanjiana)	10.41	8 23	11.19	2.12	26.16	41.89	1:6.5
Purple topped Buffel (Panicum maximum) .	12.64	11.48	14.13	1.60	21.48	38.67	1:4.5
Reed Timothy grass (Setaria phragmatoides)	11.31	12.08	15.00	1.22	28.39	32.00	1:4.2
Rhodesian Blue grass (Andropogon gayanus)	9.53	6.37	10.50	2.29	30.82	40.49	1:7.5
Rhodes grass (Chloris gayana)	12.59	8.89	13.25	1.78	25.97	37.52	1:5.1
Smooth Rhodesian Tussock grass (Setaria plicatilis)...	11.84	8.90	13.69	2.02	29.05	34.50	1:5.0
Setaria pabularis	11.23	12.72	13.00	0.88	29.28	32.89	1:4.9
Spekboom (Portulacaria Afra)	4.4	9.4	8.1	3.6	20.0	54.5	1:10.2
Sunflower plants (complete)	7.74	7.90	11.50	6.79	31.80	34.27	1:7.1
Swamp Couch (Haemarthria fasciculata)	17.64	5.79	6.63	1.52	26.68	41.74	1:10.8
Teff Grass	10.9	6.7	10.4	1.7	26.2	44.1	1:7.1
Upright False Paspalum (Brachiaria brizantha)	14.77	10.23	9.31	1.66	26.30	37.73	1:7.3
Vaalbosch (Eriosema Engleri)	12.80	4.68	9.31	2.94	27.50	42.77	1:8.3
Woolly Finger grass (Digitaria pentzii)... ...	11.46	8.43	14.25	2.01	28.58	35.27	1:4.8

(*b*) *Hay from Legumes.*

Dahl	12.00	3.73	20.12	1.80	6.84	55.51	1:3.3
Groundnut Hay	9.5	11.9	10.6	1.3	27.0	39.7	1:6.6
Lucerne (flowering stage)	74.0	2.0	4.5	0.8	9.5	9.2	1:3.2
Lupinaria	...	...	12.13	...	...	...	...
Velvet Bean Hay	9.3	7.8	13.3	2.5	27.6	39.5	1:4.2

(c) *Dried Roughage from Miscellaneous Green Leaves of Trees, Plants, etc.*

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Dolichos bean leaves... ..	...	...	17.3	...	.	...	...
Dolichos bean stems	. .	..	7.25	.		...	...
Emfenge leaves (Cussonia spicata)	22.1	6.1	6.7	2.7	15.4	47.0	1:10
Granadilla leaves..	8.92	8.13	15.37	4.64	10.88	52.06	1:4.8
Indigofera, leaves and flowers	. .		20.0		...	. .	.
Lucaena glauca, branches	13.2	7.0	18.6	2.8	19.3	39.1	1:3.5
Lucaena glauca, leaves only	10.4	10.0	17.9	5.8	12.6	43.3	1:3.9
Madagascar Butter Bean, leaves and stalks	9.2	7.4	8.1	3.6	36.9	34.8	1:9.9
M'futi tree leaves	..	..	16.2	.	.	.	...
Sunflower leaves	78.70	3.95	4.12	0.70	1.97	10.56	1:3.4
Vaalbosch leaves	6.22	7.99	14.06	8.39	26.44	36.90	1:5.9
Willow leaves (common)	11.0	5.2	9.8	2.8	17.4	53.8	1:7.9
Willow leaves (weeping)	13.9	8.8	14.4	2.5	15.5	44.9	1:4.6

III.—FRESH ROUGHAGE.

(a) *Roots, Tubers, Fruits.*

Edible Canna tubers (first year)	88.1	0.72	0.72	0.03	0.53	9.90	1:15.
Edible Canna tubers (second year)	84.4	0.60	0.77	0.04	0.63	13.56	1:20
Kigelia pinnata (Sausage tree), fruit only	85.4	0.66	0.84	0.88	4.29	7.93	1:17
Majorda Melon...	94.62	0.36	0.44	0.03	0.43	4.12	1:10.5
Prickly Pear fruit, complete	...	...	0.70	...	...	...	...
Prickly Pear fruit, pulp...	...	...	0.88	...	...	...	...
Pumpkins	86.8	0.90	1.8	0.80	1.8	7.9	1:6.4
Sweet potato tubers	78.70	0.70	1.38	0.16	0.38	18.68	1:14

IV.—SILAGE.

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Dolichos bean—							
Green	76.19	2.12	4.44	1.28	5.25	10.72	1:4.3
Air-dried	11.74	7.87	16.44	4.76	19.45	39.74	
Kudzu Vine—							
Green	62.71	4.33	4.95	1.55	11.59	14.87	1:6.1
Air-dried	13.88	10.00	11.44	3.57	26.77	34.34	
Maize—							
Green	70.79	1.45	2.08	1.68	2.80	21.20	1:13.4
Air-dried	12.13	4.37	6.25	5.08	8.42	63.75	
Napier Fodder—							
Green	73.08	3.67	1.14	0.98	10.49	10.64	1:20.5
Air-dried	10.10	12.26	3.81	3.29	35.03	35.51	
Niger Oil Plant—							
Green	66.80	3.95	4.69	4.99	7.41	12.16	1:6.6
Air-dried	7.27	11.05	13.12	13.96	20.71	33.89	
Sunflower—							
Green	81.44	2.26	2.94	1.10	3.04	9.22	1:5.0
Air-dried	11.40	10.79	14.06	5.26	14.48	44.01	
Sweet Potato tops—							
Green	82.69	2.14	2.77	0.81	2.65	8.94	1:4.9
Air-dried	11.70	10.92	14.13	4.12	13.54	45.59	
Sunn-hemp (green)	78.24	2.00	2.53	0.69	10.71	5.83	1:7.2
Veld Grass (Red soil) air-dried (3 analyses)	14.8	7.9	5.7	1.6	26.2	43.8	1:12.9
Veld Grass (Sandveld), air-dried (2 analyses)	9.7	7.2	3.7	0.6	40.1	38.7	1:22
Vlei Grass, air-dried (3 analyses)	10.6	8.6	5.5	2.3	33.5	39.5	1:14.2
Velvet Bean—							
Green	81.11	2.29	2.94	1.17	5.00	7.49	1:5.2
Air-dried	9.43	11.01	14.12	5.62	23.98	35.84	
Velvet Bean, plus Maize Air-dried	7.6	3.1	10.2	3.8	12.9	62.4	1:8.2

Charcoal-Gas as Fuel for Farm Tractors.

By W. F. COLLINS, Assoc.R.S.M., "Riverside," Marandellas.

During the last two years the Rhodesian motorist has become accustomed to the sight of charcoal-driven lorries, distinguished by the presence of one or two large steel cylinders for the production and cleaning of the motive gas, generated from local fuel. These lorries are known, though troublesome to inexperienced drivers, to have remarkably cheap fuel mileage. Considerable research is being devoted to the use of this fuel for road transport in many countries.

It has been claimed that suction-gas can be used for farm work also, though the difficulties are much greater and there have been many failures. In view of the high cost of tractor fuel-oil in Africa and the ever-recurrent controversy as to relative merits of ploughing by tractor or by oxen, experience under circumstances in which a charcoal-tractor and ox-ploughs have been in simultaneous operation for two seasons can scarcely fail to be of interest.

On the Riverside Tobacco Estate, Marandellas, tobacco crops up to 200 acres have been grown for many years, the ploughing being done by ox-drawn three-furrow ploughs, supplemented by a 15-30 h.p. tractor working, until 1931 on kerosene. Gas-oil was then substituted as a fuel and, on the introduction of the "High-speed Gas" process into Rhodesia in 1932 it was decided to still further reduce fuel cost by the use of charcoal-gas. The plant was fitted and the required acreage successfully completed in time for planting.

Difficulties attending the use of Charcoal-Gas.—It is probable that many failures have been due to the fact that manufacturers of producer-plants neglect to warn their clients of the numerous troubles which follow neglect to take certain precautions. With a standardised fuel such as kerosene the difficulties are now widely understood. Charcoal, however,

is never pure and there is no standard of quality. Good charcoal is not easy to make and the gas is apt to be contaminated with mechanical and tarry impurities.

1. *Manufacture of Charcoal.*—Despite the existence of a number of useful articles and Government publications dealing with the manufacture of charcoal on the farm it must be admitted that the question of the production of first-class fuel has been sadly neglected in high places. Crude wood and any charcoal are in current use in heavy suction-gas plants throughout the world and owe much of their success to elaborate scrubbing and cleaning of the gas in heavy plant unsuitable for light transport. Until considerable further research has been devoted to the subjects of nature of wood, design of kiln and technique of carbonisation the question of fuel must continue to be a serious difficulty. Two of the chief troubles first encountered were found to be due to the use of unbarked wood in the manufacture of the charcoal and in the use of fuel screened to too small a size. A beehive kiln, built with thick brick walls, has been found to be the most suitable for producing good clean fuel. Thorough carbonisation at the highest possible temperature is most important. For light engines it is essential that all tar be distilled off in the kiln and not in the machine.

2. *Starting Difficulties.*—Under normal circumstances the starting of a lorry-engine, fitted with a self-starter and battery ignition, after the use of charcoal-gas, is a fairly easy operation. It must be explained that the use of this gas involves the deposition of an alkaline salt, possibly carbonate of potash, on the plugs, interfering with their insulation. The tractor usually has weak-tension magneto ignition and must be started by hand. Fouling of engine and plugs to some extent is inevitable with charcoal-gas and starting troubles are greatly accentuated. Tractor carburettors also are not too easy of adjustment. They are apt to get out of order under farm conditions. When to these troubles are added the possibility of magneto breakdown and uneven distribution of petrol to the cylinders through unequal fouling of the manifold ports, it will be realised that success can scarcely be gained without considerable experience and the expenditure of much hard cranking. Starting sometimes

seemed almost impossible until the novel expedient was discovered of spinning the power-pulley by rope or wire with a team of boys, an experience now happily almost a memory only.

3. *Load.*—A lorry runs for a considerable proportion of its time on light load and, if any difficulty arises in connection with its gas power one may find relief in switching over to petrol. The tractor is normally at full load, or nearly so, and if there be trouble it must be stopped until all is in order. Stoppage after some hours of working may be followed by starting difficulty through foulness of plugs, especially if there be some other defect, however small, in the system.

4. *Supervision.*—When the tractor is in satisfactory operation there is found to be no undue risk in entrusting its driving to a reasonably intelligent native. The starting of it, however, involves a change-over from petrol to suction-gas, and hitherto this operation has been found too complicated for a farm-trained native. Refuelling, drop in power-output for any reason and the general safety of the engine require the constant presence of white supervision. In view of necessary reduction of power output due to altitude, smaller cylinder-capacity and high atmospheric temperature, the cost of white supervision per acre ploughed is unduly high. Provision of more powerful machines than those at present obtainable for agricultural purposes or the supervision of two machines at a time would appear to be the only possible solutions of this difficulty.

First Season's Work.—Apart from narrowly-averted disaster due to loosening of bolted-on piston-head adapters, promptly discarded for specially-cast piston-heads, most of the difficulties and delays encountered during the first season's work were due, it must be admitted, to inexperience under the new conditions. Lessened power-output resulted in the use of four 28 inch discs only instead of the five previously in use with gas-oil. Poor gas due to the use of small or unbarked charcoal, fouling of pipes, engine and plugs, leakages and minor troubles inherent to the new conditions, added to the anxieties to which all tractor-drivers are condemned, caused serious doubt as to whether it would be possible to complete the campaign before the end of the plant-

ing season. Specialist assistance was called in on one occasion only however, and in this case the fault was found to lie rather in the use of poor fuel than in mechanical defect. Much of the trouble throughout might have been avoided had detailed instructions as to operation been available. The work was finished at small cost for repairs, with a low engine-oil bill and at a cost for fuel of about a tenth of the sum expended in the previous year.

Second Season's Experience.—The second season's work was started with misgivings that the previous operation, followed by weekly employment in mealie-milling under gas-power, at a fuel cost of something under 2d. per bag, might have lessened the power-capacity of the tractor. These fears, however, proved unfounded. Detail improvements in gas-production and closer attention to regular cleaning caused the work to be more constant. Detection of sources of trouble was quicker and stoppages became less frequent. The campaign, involving the ploughing of a larger acreage, was completed in a time considerably shorter and the cost of repairs was negligible. The engine's condition remains good. The removable cylinder-linings are those originally supplied with the engine, now six years in use.

For milling operations at the end of the season it was found possible to use the small charcoal, down to pea size, discarded as being unsuitable fuel when ploughing. For this stationary work the cleaner was partially filled with water. Scrubbing of the gas in this manner is found to result in greatly decreased fouling of pipes and plugs, more even power output and decreased trouble in general.

Summarising the experience of these two seasons:—

1. *Charcoal.*—The chief requirement for successful operation in the field is clean, dry charcoal, carbonised to a high temperature in the kiln and derived from barked m'sasa (or other suitable) wood, sized to remain on a 1½ inch sieve.

2. *Cleaning.*—There must be a regular routine of cleaning:—

(*a*) Daily. Producer and its gas outlet. Dust-chamber. Plugs.

(*b*) Every three days.—Butterfly gas-valve. Dust catcher.

(*c*) Every fourth day.—Manifold and engine-inlets. All pipes of the manifold must be carefully cleaned. If tar be left in either of the ducts the petrol-gas supply will be uneven and petrol-starting difficult. Joints of flexible main.

(*d*) Every three or four weeks.—Valves and cylinder chambers.

3. *Gas-joints.*—These require constant attention in order to avoid leakage inward of air and thus premature combustion of gas. Such leakages may often be detected through abnormal temperature at the point concerned. Stoppages lower the temperature of the system and increase the vacuum between the point affected and the engine. For their detection one or more vacuum-gauges might well be fitted.

4. *Valves.*—Close attention to adjustment of valve clearance assists greatly in eliminating starting-trouble.

Cost of Operation.—Taking the cost of farm-made charcoal at the rather wide limits of 6d. and 1s. per bag of about 70 lbs., the fuel-cost of operation was found to be about 1s. per acre, or slightly over 6d. per hour. The Germ oil used amounted to under a quart per four acres. The average daily output was about four acres with working-time, including stoppages, of about nine hours. Schwantes and Pond in their survey* of tractor operation in Minnesota, find the total cost of operation of farm tractors in that State amounts to approximately 4s. 5d. per hour, not including white labour. It is obvious therefore that though the hourly output of a charcoal tractor in Southern Rhodesia must of necessity be inferior to that of the kerosene tractor in the States, the cost of operation is many times less.

It has been possible at Riverside to compare the work of this tractor with that of two three-disc ox-ploughs working continuously through the day by using two spans each. These two ploughs together, working with sixty-four oxen and

*Schwantes, A. J., and Pond, G. A.; Farm Tractor in Minnesota. Univ. of Minnesota, Bull. 280, 1931.

slightly smaller discs, were able to produce, with very little white supervision, about the same output per day as the tractor. The tilth of the soil, however, was better with the tractor-plough. Cross-ploughing, necessary in the case of the ox-ploughed work, could in case of urgency be dispensed with under tractor-ploughing. Ox-ploughing by native drivers involves smaller capital but is less satisfactory, especially under hard ground conditions, and results in inferior tilth.

The use of this fuel for small-power tractors for ploughing would, no doubt, through initial loss of power and high cost of white supervision in relation to output, be entirely uneconomic under Rhodesian conditions.

Sweet Potato Tubers.

Supplies of the best varieties of the above are available from the Agricultural Experiment Station, Salisbury, at 7s. 6d. per petrol case, f.o.r. any station or siding in Rhodesia. The tubers are treated with lime before despatch to ensure delivery in good order.

The following varieties are available and recommended:

Early Butter, Linslade } Highest yielders of tubers.

Calabash.—High yield of tops.

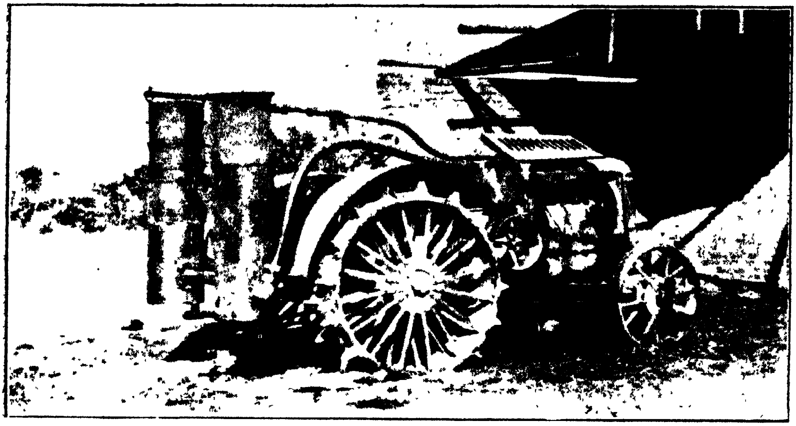
Early Butter, Red Nansemond, Yellow Jersey } Best table varieties.

Information concerning the method of sprouting the tubers was published in the September, 1929, issue of the *Rhodesia Agricultural Journal.*

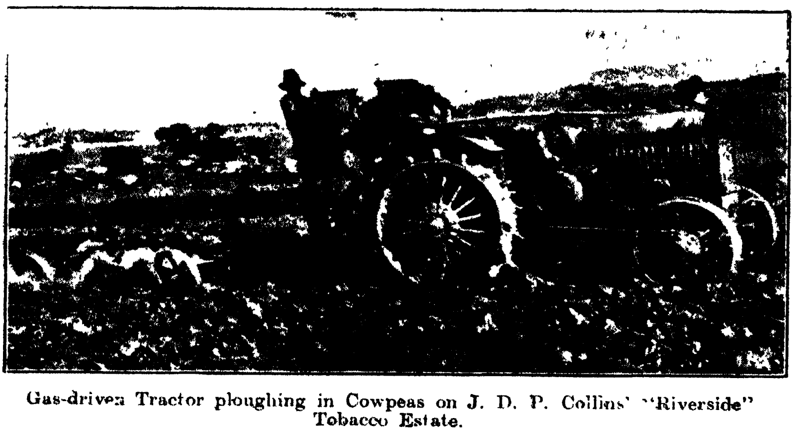
Commence sprouting after danger of frosts is past. Three cases of tubers will supply slips for planting one acre.

Cheques should be made payable to the Department of Agriculture, and should accompany orders.

The farm-built beehive oven used for burning charcoal on the "Riverside"



Gas-driven Tractor ready for Milling, on the "Riverside" Estate.
Tobacco Estate.



Gas-driven Tractor ploughing in Cowpeas on J. D. P. Collins' "Riverside"
Tobacco Estate.

Further Notes from the Cotton Station, Gatooma.

By J. E. PEAT, Empire Cotton Growing Corporation.

Each year a detailed report on the work of the Cotton Station at Gatooma is published, along with reports from the other stations in which the Empire Cotton Corporation is interested. In this is set out, in a form probably rather indigestible to most non-technical readers, the results of the year's work.

Last year, in the September number of the *Agricultural Journal*, an article intended for growers was published, summarising ideas and conclusions resulting from the work of the Station. It is probably valuable at intervals to bring such information up to date in the light of the further experience gained.

American Bollworm.—The extent to which the American bollworm attack is the limiting factor to cotton expansion in most of the potential areas of the country is now clearer than it was last year. It is important that growers should appreciate the position and what measures are practicable to assist the production of profitable yields in spite of American bollworm attack.

Marked Importance of Crop Earliness.—A most important factor in these areas is crop earliness, not only calendar earliness, but earliness, even in a late season, relative to the other crops planted, especially maize. Even in a year of late planting rains, cotton should be as early as possible relative to maize; the lands should be in a state of tilth to give the crops a good jump off; the plants should be thinned out early and the lands kept clean early in the season, so that the growing plants suffer the minimum of check. The idea is to have set, before the Amercan bollworm attack becomes heavy, as large a crop as possible of formed bolls.

American bollworm moths are endemic to the country. A range of crops are attacked at the budding and flowering stage. Ordinarily a planting of maize is attractive to the egglaying moths just before and during the period of taselling, *i.e.*, roughly the period 50-70 days after planting. It appears to be only after the maize crops in the area are past the attractive stage that the American bollworm moth starts the heavy egg-laying on other crops attractive at that time, an important one of which is cotton, then in full flower. The main egg-laying on cotton seems to occur from about 80 to 100 days after planting, with peak egglaying around 95 days after planting. In a normal year the egglaying on cotton occurs in late February and in March, producing the March boll-worm attack, which may cause heavy loss of buds, flowers and young fruit. If the crop is early the bigger bolls, which have set, mostly escape damage, and in a year of fairly serious American bollworm attack, this represents the greater part of the crop reaped.

Trapping, American Bollworm Egglaying.—Experiments have been carried out in the use of late planted maize as traps, to attract a portion of the American bollworm egglaying from the cotton crop. In other areas the use of these traps appears to have been effective. It is difficult to say in this country what extent they may have affected the position this year. But as the later maize can be used for ensilage these trap plantings of maize are well worth a trial. Normally the commercial maize is planted from towards the end of November into December. It is suggested that the trap maize plantings be fair sized blocks, close to the cotton lands, the first planted about a fortnight after the last of the bulk maize, in a normal year about the end of December, and the second a fortnight later, about the middle of January. It must be emphasised that these trap crops are only attractive to the American boll-worm egglaying for about a fortnight, *i.e.*, during the period that they are just coming into tassel and immediately afterwards.

Other crops nearby, if at the attractive stage, must influence the amount of American bollworm egglaying which takes place on the cotton crop. Sunflowers, for example, are attractive to the moths for the period from about 70 to 100

days after planting, and Kaffir Corn 70 to 90 days after planting. Sunn-hemp is attractive, and beans are highly attractive, at the budding and early flowering stage.

Seed Strain.—The importance of a satisfactory seed supply can scarcely be over-emphasised. It is essential that growers should realise that there are very definite strain differences, and they should ensure that their seed be from strains suited to their conditions. There may be such a difference in yield between one seed strain and another as to represent possibly the difference between profit and no profit.

It would appear that several of the jassid resistant U.4 strains, bred up at the Cotton Station, Gatooma, especially derivatives of U.4/64, (Gatooma, 5), early maturing and heavy yielding, are capable of producing satisfactory yields in spite of American bollworm attack, where crops grown from ordinary seed are yielding little. It is likely that the small size and more open habit of these strains make them less attractive to American bollworm egglaying. Not only did this show up at Gatooma this past season, but elsewhere throughout the country.

U.4/64 has proved the outstanding parent stock. This past season at Gatooma, with an early crop, and a fairly heavy American bollworm attack, the old jassid susceptible Improved Bancroft was producing a negligible yield; the original Mixed Bulk U.4 was yielding around 500 lbs. per acre seed cotton; by contrast, U.4/64/7/10 (Gatooma 5, 11) and U.4/64/V (Gatooma 5, 21) were yielding, in bulk, 800-900 up to 1,200 lbs. seed cotton per acre, and some of the newer improved U.4/64 strains were yielding even better.

In plots planted with the old original U.4 Mixed Bulk seed, many of the plant types are unproductive and fairly late maturing. As a result of this, after the American bollworm attack, there is not the same restraining influence of the maturing crop as with the more productive lots. The plots of U.4 Mixed Bulk could always be picked out by the small crop carried and by the lanky unproductive nature of a large proportion of the plants.

Of the families other than U.4/64 only U.4/26/B/2 (Gatooma 2, 26) has made anything approaching a satisfactory

showing against the /64 derivatives. /26/B/2 is a fairly early maturing strain, fruiting freely, but with only moderate lint quality.

In the /34 family the very excellent jassid resistance was maintained, but the late habit and plant size appeared to be the cause of the strain suffering very severely from American bollworm attack. The opening was not satisfactory; the yields were relatively poor; and the lint quality was not too good. The /78/3 lots behaved in a similar fashion. No one of the derivatives of these strains was at all comparable with the better U.4/64 lots.

The two strains in bulk, seed of which is being distributed for next season, are /64/7/10 (G. 5, 11) and /64/V (G. 5, 21). Seed of these two strains, grown at the Cotton Station this past season, has been advertised for distribution at 1d. per lb. Both have done well this year at Gatooma and throughout the country. /64/7/10 has proved a good parent stock. It matures earlier than /64/V and is more open in habit, both very important characters in the light of what has been said about American bollworm attack; but it has not such good jassid resistance; it has a lower ginning percentage; and does not give lint of such good character as the /64/V lint.

/64/V, because of its better jassid resistance, better lint character and better ginning percentage, is probably the better strain, but the earlier habit of /64/7/10 makes it a safer strain to grow. So far none of the /64/V lots is showing up as sufficient improvement on the parent stock to justify its issue at this stage, but several improved lots of the /64/7/10 type with a slightly better jassid resistance, early, and more uniformly heavy yielding, have been multiplied. Seed of these newer /64 lots, for multiplication, has also been advertised at 1d. per lb.

A big effort is being made to get a strain with the /64/V quality of lint and jassid resistance, with the early and, more open, free fruiting habit of /64/7/10, by selection, either out of the /64/V lots, or out of the /64/7/10 lots.

Soil.—Apart from strain differences, lint quality depends very largely on the type of soil on which the crop has been grown, and the extent to which the soil has been able to carry

the crop through without major checks. It is asking too much to expect, especially in a difficult year, good quality lint and satisfactory yields from worn-out land in poor heart. Land in at least fair heart, is required to produce the frame-work necessary for a satisfactory crop.

There must always be a certain natural loss by shedding, the amount of which is largely influenced by the weather in February and March. But even in a year of drought crops on better quality land suffer very much less.

A word of warning is necessary. Where soil is rich and heavy, growth is greater and plants are larger, inducing lateness of the crop. In addition, a rank style of growth appears to be more attractive to the egglaying American bollworm moths. Under these conditions early planting is of the greatest importance.

There is little to add to what has previously been said about spacing. With moderate land a spacing of plants about six to twelve inches in the row, leaving two plants per hill where gaps occur, seems to be giving the best results. Under richer conditions a slightly wider plant spacing in the row is probably an advantage, up to 2 feet between plants.

The great importance of obtaining a good stand should be mentioned, and the importance of early thinning in connection with American bollworm attack might again be stressed.

While on most red soils it does not seem to pay to fertilise cotton directly, good results are obtained with cotton grown after other crops fertilised the previous year. On the lighter soils cotton may respond more freely to direct fertilising. Good results have been obtained with cotton after a green manure crop. On the heavier soils after a green manure crop it would probably be better to take off a maize crop before planting cotton.

Picking.—Without adding much to the cost of the operation many growers could improve their picking methods. As soon as pickers can bring in a fair daily weight it is probably wise to start picking the clean white cotton which is ready. Later, the slightly stained and less well opened bolls, containing a certain amount of immature cotton, can be picked

in with the second picking. It is probably better to do this rather than to try to pick everything into one picking, thus lowering the value of the 70-80 per cent. of that picking which is first grade cotton. The rubbish, costing more to pick than it is worth, is best left on the plants; if picked in with the better seed cotton it reduces the value of the sample. Cotton deteriorates if left on the plant in the field. Not only does the inherent lint quality deteriorate, but fragments of broken bracts and leaf become mixed up with it, lowering the value. Much of the cotton coming in this year was dirtier than it might have been. The mixing in of dirty second grade cotton lowers the value of the whole sample, the greater part of which may be of good quality and fairly clean. The wiser procedure appears to be to pick as early as possible a fairly clean first picking and then to take the remainder of what is worth having in the second picking.

It is important too to pick early that portion of the crop intended for seed, to ensure seed relatively free from staining. Seed cotton left long on the plants before picking generally gives seed with a greater amount of staining.

The above remarks have been emphasised by the experience at Gatooma this year where, with 140 acres under cotton, and a very heavy crop, picking has had to be spread over four months. The later pickings, even of similar growth, are definitely poorer in quality than the earlier pickings. The seed cotton is dirtier, with more broken leaf and bracts mixed in with it; it has been blown about more and therefore has been more expensive to pick; and the seed shows more staining.

Stainers.—The stainer problem, important in most areas of the country, is a serious problem in parts of the lower veld. It is receiving a considerable amount of study, particularly in relation to the veld host plants and their fruiting. In most areas, in reducing the amount of stainer loss, crop earliness is again important. In Gatooma, this past season, in weekly examinations of bolls, it was striking as the season advanced how the number of stainer punctures per 100 bolls, and the degree of staining, increased.

It is difficult to gauge, with a moderate type of attack, the effectiveness of seed trapping; but it is probably worth

doing early in the season—from about the middle of February until about the end of March—before the bolls open and the first adults come in from the veld.

Sudan, or Red, Bollworm.—A system of controlling Sudan bollworm by trapping, in November, with stand-over cotton, is being carried out at Gatooma, but to be effective the method of control requires careful application.

Sudan bollworm is specific to cotton, and relatives of cotton which are comparatively scarce in most areas in this country. Thus the Sudan bollworm attack from year to year is probably largely a carry-over from the previous year. Where cotton is being grown on any scale over a number of years, Sudan bollworm will probably tend to become of increasing importance, taking year by year an increasing toll of the maturing bolls in the latter part of the season.

The main emergence of the moths from bollworms which have gone down to pupate the previous May, June and July, is around the time of the first rains. In the Gatooma system of control the egglaying of this main hang-over emergence is attracted to some two or three acres of ratooned or stand-over cotton.

Normally in the absence of such ratooned or stand-over cotton, the emerging moths during the month or so of their lives, start egglaying towards the end of December and in January on the small annual cotton plants. From this egg-laying probably works up much of the main attack later in the season. In the presence of ratooned or stand-over traps the greater part of the egglaying from the emerging moths is attracted to them. But unless care is taken, the Sudan boll-worms hatching out from the eggs laid on these traps can go through their life history, feeding on the flower buds and young bolls, and themselves go down to pupate. If this happens, the end result is worse than the initial state. Instead of reducing the Sudan bollworm population, a population is being bred up to attack the annual crop later in the season.

To prevent this it is necessary, at intervals of about three weeks, to clear the trap of all bolls and formed flower buds. Much of this can be done by grazing the patch down with oxen, and then stripping the bolls and buds left on the plants.

The danger is that this operation requires to be done at a time of the year when all available labour is very fully employed cleaning. If not done at least every month, mature larvæ will have gone down to pupate.

It has been found that well-grown leafy cotton plants, even though not flowering, are fully attractive to the Sudan bollworm moths. Experiments are being conducted using blocks of free-growing perennial cotton which start flowering only late in the season and then not freely. On such plants, with little food supply, most of the bollworms hatching out from eggs laid would die and the control of the few left would be simple.

At Gatooma, as a result of the trapping practised this last year, annual cotton crops have been kept relatively free from Sudan bollworm attack, contrasted with the last few years, when the Sudan attack on the maturing bolls—that portion of the crop left after the American attack—was becoming increasingly serious.

Ratooning.—In the light of what has been said, it can be seen that, from the point of view of Sudan bollworm attack, apart from the other disadvantages, the practice of ratooning is unsound. Ratooned crops would act as breeding-up grounds for Sudan, which each year would inflict a heavier and heavier loss on the annual crop. Over a period of years, with ratooned cotton being grown, it would probably become difficult to pull off successful annual crops.

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 20. July, 1934.

The position during the month has shown little change. The only species of locust recorded has been the Red Locust (*Nomadacris septemfasciata*, Serv.).

Winged swarms of this species have been present in most parts of the Colony, but have not exhibited much movement nor attracted much attention. As was the case last year, the Eastern Border appears to be a favoured haunt of these swarms, probably due to the higher humidity. Swarms cross and recross to and from Portuguese East Africa.

Movement of swarms as recorded have taken place in all directions and there is no evidence of any definite trend. The higher ground and hilly country appear to be attractive at this time of year.

Enemies and Disease.—The month of June was unusualy mild and humid, especially on the Eastern Border, and this seems to have been responsible for a recrudescence of *Empusa grylli*. Locusts were observed or reported to be dying from this disease in large numbers in that region up to the third week in July, whole swarms being stated to have settled and failed to move again. Away from the region of the Eastern Border the disease was not, however, noticed in July, all swarms examined being apparently healthy.

No other enemies or diseases were recorded during the month.

Outlook.—No change. The position is likely to reveal itself more clearly with the advent of warmer weather and increased activity on the part of the swarms.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

JUNE, 1934.

AFRICAN COAST FEVER.

Smears taken by the Cattle Inspector on the 22nd June from an ox which had died in a paddock on the Wiltshire Estate, Charter District, revealed the existence of Coast Fever. The herd number 1,247; mortality 8.

TRYPANOSOMIASIS.

Thirteen cases in the Hartley District.

ANTRAX.

One case occurred on an infected farm in the Mazoe District amongst a newly introduced herd, the remainder were inoculated. Also one case in the Mtoko infected area.

TUBERCULIN TEST.

109 head of cattle were tested on importation; no reaction.

MALLEIN TEST.

73 horses and 10 mules were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Bulls 8, cows 48, heifers 53, horses 64, sheep 236, mules 10.

EXPORTATIONS.

Sheep 343.

Cattle to Durban for export overseas 2,175. To Johannesburg for local consumption 887.

To the United Kingdom *via* Union Ports in Cold Storage: Beef quarters, 404; boned quarters, 3,168; veal boned quarters, 178; tongues, 11,492 lbs.; livers, 20,657 lbs.; hearts, 5,108 lbs.; tails, 2,752 lbs.; skirts, 3,074 lbs.; shanks, 6,728 lbs.; kidneys, 816 lbs.; glands, 1,390 lbs.

Meat products from Liebig's Factory:—Meat meal, 208,000 lbs.; bone meal, 91,400 lbs.; beef fat, 53,760 lbs.; tongues, 1,476 lbs.; tallow, 57,824 lbs.; bones, 360 lbs.; beef powder, 43,196 lbs.; meat extract, 35,613 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JULY, 1934.

Pressure.—Barometric pressure for the month was uniformly low over the whole country.

Temperature.—Mean temperatures were generally 2 to 4° above normal over the country, both minimum and maximum temperatures being well above normal.

This winter has been remarkable for the absence of frosts and is the warmest on record.

JULY, 1934.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Pressure Millibars, 8.30 a.m. Normal.	Temperature in Stevenson Screen °F. Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	Mean. ½ Max. Min.	Mean. Normal.	Mean. Dry Bulb.	Mean. Wet Bulb.	Rel Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Precipitation. Normal	Precipitation. No. of Days	Altitude (Feet)
Angus Ranch... ...	...	...	84	46	76.5	51.7	64.1	60.4	59.3	53.5	69	50	...	...	.15	...	...
Beit Bridge	970.8	...	93	33	79.9	46.4	63.2	...	62.2	55.0	63	50	2.0		.25		1,500
Bindura...	896.3	...	80	41	74.5	48.5	61.5	...	58.4	51.8	65	47	2.0	...	.04	...	3,700
Bulawayo	872.7	873.4	81	41	72.6	46.8	59.7	56.8	57.8	49.3	54	42	2.0	...	.05	...	4,426
Chipinga	897.4	...	78	45	69.5	50.9	60.2	...	60.5	53.9	68	50	3.5	.51	.63	7	3,685
Enkeldoorn	861.6	...	78	38	70.6	45.7	58.2	56.1	57.5	50.4	62	45	1.9	.02	.09	1	4,788
Fort Victoria	900.4	901.1	82	37	72.9	44.3	58.6	55.0	57.6	51.0	65	46	1.5	...	.11	...	3,571
Gwaai Siding	909.0	...	86	33	79.7	42.2	61.0	...	58.8	49.0	40	40	1.1	...	...	...	3,278
Gwanda	910.9	...	86	35	74.3	47.6	61.0	...	57.7	50.8	62	45	2.3	...	.08	...	3,229
Gwelo	866.7	...	81	38	71.7	45.1	58.4	55.5	55.7	49.1	65	48	1.9	.03	.02	1	4,628
Hartley	890.7	...	82	38	76.5	44.0	60.2	58 2	56.8	50.1	62	44	1.1	...	.01	...	3,879
Inyanga	840.2	...	72	37	66.2	45.2	55.7	...	57.2	48.5	54	41	2.0	.04	.15	1	5,514
Marandellas	841.2	...	74	40	67.4	46.1	56.7	...	56.3	48.9	60	43	1.9	.04	.08	2	5,452
Miami	883.0	...	80	44	73.6	46.9	60.3	...	60.1	53.1	64	48	2.2	...	.10	...	4,078
Mount Darwin ...	912.2	...	81	38	75.9	47.7	61.8	..	61.5	55.4	69	51	4.0	...	.01	...	3,180
Mount Nuza	804.7	...	63	38	55.3	43.3	49.3	...	49.1	44.6	73	40	4.2	1.25	...	7	6,668
Mtoko	881.9	...	79	44	72.6	50.7	61.7	...	60.2	53.5	65	49	2.5	...	.03	...	4,140
New Year's Gift...	...	...	86	45	76.3	50.7	63.5	...	58.6	53.3	70	49	...	.27	.24	4	2,690
Nuanetsi	968.4	...	90	35	79.1	45.0	62.1	...	62 3	54.6	60	48	2.6	...	.04	...	1,580
Plumtree	868.0	...	79	40	72.9	50.5	61.7	..	59.7	49.7	49	40	1.1	...	.05	...	4,549
Que Que	886.8	...	84	41	75.5	47.2	61.3	...	60.2	51.6	56	45	1.7	...	.02	...	3,999
Rusape...	866.3	...	76	37	69.2	44.2	56.7	...	55.2	50.2	71	41	2.0	.13	.21	2	4,647
Salisbury	858.6	859.2	78	37	71.2	45.8	58.5	56.3	58.5	50.8	59	44	2.4	.02	.03	1	4,885
Shabani	912.7	...	85	45	74.5	50.3	62.4	...	58.3	51.6	64	47	2.0	.04	.03	2	3,193
Sinoia	892.5	...	83	35	76.3	41.8	59.0	...	58.5	51.1	60	45	1.4	.01	.03	1	3,794
Sipililo	889.5	...	79	40	73.3	49.5	61.4	...	60.0	52.5	62	47	2.0	...	.03	...	3,876
Umtali...	897.6	898.4	80	41	71.6	49.5	60.6	58.4	58.8	53.8	74	50	3.8	.22	.28	4	3,672
Wankie	931.6	...	84	48	82.4	55.7	69.1	...	61.9	51.7	49	43	0.8	...	.01	...	2,567

Farming Calendar.

SEPTEMBER.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cynaide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on every young fruit. A useful spray against black aphis and thrip is the following:—Nictone, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenuous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuce, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

OCTOBER.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stocks require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough in December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time

of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," September, 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm (*Heliothis obsoleta*).

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation.

Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds, especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease," is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and carmp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate, it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleansed out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

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No. 639. Diseased Plants for Examination: Collecting and Despatching the Material, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
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No. 714. Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.
No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
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No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
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No 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T,A., Chief Botanist and Mycologist.
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No. 796. The Army Worm (Laphygma exempta, Wlk.), by Rupert W. Jack, Chief Entomologist.

No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

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No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist. Pathologist.

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No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist

No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.

No 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.

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No. 896. A List of Plant Diseases Occurring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S , Chief Entomologist.

No 899. The Black Maize Beetle (Heteronchus Licus Klug), by C. B. Symes.

No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust, *Nomadacris septemfasciata*, Serv., by M. C. Mossop, A.F.C., M.Sc., Entomologist.

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No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.

No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.

POULTRY.

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Hints to Breeders. Prepare for the Breeding Season, by A. Little.
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Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

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No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
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No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc (Eng.).
No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

MISCELLANEOUS.

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No. 554. Pisé-de-Terre, by P. B. Aird.
No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
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No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.
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How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia.
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No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Division.
No. 910. The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F. Duguid, M.A., B.Sc.
No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A.I.Mech.E.
No. 925. The Maize Control Amendment Act, No. 17 of 1934, by E. R. Jacklin, Chairman, Maize Control Board.
No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.

FARMERS' WANTS.

Advertisements under this heading will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words. The charges for these advertisements must be prepaid, and advertisements will appear on this page each month.

MISCELLANEOUS.

Our BUTTER WRAPPERS are guaranteed free from impurities and are printed with waterproof ink.—Art Printing Works, Ltd., P.O. Box 431, Salisbury.

FOR SALE.

ART PRINTING WORKS, LIMITED, P.O. Box 431, Salisbury.—Boys' Tickets, 1s. per 100; Butter Wrappers; Stock Lines Books—Order, Invoice, Delivery, 2s. each; Receipt Books from 1s.; Account Books from 3s. 6d.; Good Pencils from 1s. 6d. per dozen; Envelopes from 5s. per 1,000; Air Mail Writing Pads, 200 sheets, 1s.; Opaque Envelopes 1s. per 100; Fountain Pens from 4s. 6d.; Files from 1s. All kinds of Stationery for Home or Office.

THE RHODESIA

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(Assisted by the Staff of the Agricultural Department).

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

New Minister of Agriculture.—At the special request of the Prime Minister Captain F. E. Harris, D.S.O., has accepted the Portfolio of Agriculture. His willingness to accept the duties of Minister of Agriculture is appreciated by all, and we trust his term of office will be a long and pleasant one. Captain Harris is Devonshire by birth and came to Southern Rhodesia more than thirty years ago, when he started on a successful business career in Bulawayo. He has been closely associated with all branches of farming and ranching, and his popularity with both the business and farming communities has been amply demonstrated during the last few weeks. During the Great War he served with the 2nd Rhodesia Regiment and later with the 2nd Devons, and while in France was

awarded the D.S.O. His special interest in the farming community was responsible for his appointment to the Danziger Commission, and the experience gained on that body will be of great value in his new duties. Maize Control still claims a good deal of public attention and, as a member of the Board since its inception, he is in an excellent position to deal with this important subject. In every way Captain Harris is particularly well equipped for his present post, and we look forward with every confidence to a successful term of office.

Flour to the Union.—Information has been received that there will be no objection to the introduction into the Union of South Africa of boer meal and flour from Southern Rhodesia, provided the products are railed in sealed trucks and are accompanied by a certificate issued by the Southern Rhodesia veterinary authorities showing that they have been derived from areas not less than 50 miles from the external cordon of any foot and mouth disease infected area and that they have not been subsequently contaminated with infection of foot and mouth disease in store or in transit.

Reward of Locust Precuations.—The following interesting note was received recently from the Principal of Driefontein Mission:—

> "When the hopper campaign was at its height, we put a trench, approximately 2 ft. 6 in. x 2 ft. 0in. wide round our wheat lands. The parapet was thrown on to the wheat side. For the first time we have not had any Spring Hares in the wheat, except only, and very noticeably, where the trench had been filled in for a short space. That seems to be the only place where the Spring Hares, numerous everywhere, dare to cross."

Small Game and Birds and Locust Poison.—It has been suggested that killing locusts by means of arsenite of soda may be the means of poisoning large numbers of small game and birds in this Colony. In a recent issue of the *Sunday Times* it was definitely stated that evidence of the destruction of

small game from eating poisoned locusts can frequently be seen in Zululand. Further, several farmers have reported that since the spraying of locusts has been carried out on their farms large numbers of guinea fowl have apparently been killed. The Department is anxious to obtain definite information, particularly in regard to birds. Farmers can assist in this matter by sending the crop and stomach of any bird found dead during the coming locust season. These should be sent in a tightly closed jam jar and addressed to the Chief Chemist.

Price of Wheat.—An arrangement has been concluded between the Government and the Rhodesia Milling and Manufacturing Company, Limited, whereby the latter undertake to purchase the whole of this year's wheat crop on the same terms as last year. The price paid will, therefore, be 22s. 6d. per bag of 203 lbs. gross, free on senders' rails, for fair average quality wheat weighing not less than 62½ lbs. per bushel.

Owing to the climatic conditions experienced during the winter rust has been particularly prevalent all over the Colony, and farmers who have grown varieties which have not suffered to any great extent from rust this season should take care to retain sufficient seed for their own requirements and, if possible, to supply other farmers' seed requirements for next season.

Crested Wheat Grass (*Agropyron cristatum*).—Crested Wheat Grass is a native of Russia and Western Siberia. It was first introduced into the U.S.A. in 1898 and into Canada in 1915. A small supply of seed was obtained by Mrs. E. G. Birch, of Maybrook, Fort Victoria, in 1933, and some of this was kindly supplied to the Department for testing on the Salisbury Experimental Station. The following particulars are taken from a Canadian bulletin recently received. It is a perennial which spreads itself by seed and also by short underground stems. In good soils it grows to a height of 30 to 40 inches and produces a large amount of excellent feed. When established it has an abundance of roots which penetrate the soil to a great depth, and on this account is very drought resistant. It likes a sweet soil and will probably not

do well in vleis. It possesses a good feeding value with almost 19 per cent. of crude protein in the young stage and 10.3 in the flowering stage under Canadian conditions. The average content of hay over four years was found to be 9.73, and the average weight of hay cut was 1,925 lbs. per acre. Perhaps one of the most important points in favour of this grass in Canada is its free seeding habit, where up to 900 lbs. per acre has been reaped. The average is stated to be 300 lbs. of clean seed per acre. The land should be clean and fairly compact, and it is essential that it should be moist at the time of planting. It should not be planted more than ½ inch deep, and if an ordinary planter cannot be adjusted for this purpose it should be broadcast and harrowed in. When grown for seed it should be grown in rows 3 feet apart. If sown broadcast and there is an abundance of moisture in the soil, 20 lbs. of seed should be used per acre. The variety Fairway has been found to be particularly suitable for lawns, golf courses, etc. In the drier parts of Canada several lawns have been found to keep their condition in severe drought without being watered.

Warning to Tobacco Growers.—After consultation with the various interests concerned the Minister for Agriculture has decided that it is advisable to warn all tobacco growers that if next season's crop amounts to 80 per cent. of the 1933/34 production, so far as it can be seen to-day, it may be in excess of marketing requirements.

Growers in their own interests are, therefore, advised to keep this position in view and to concentrate on the production of a higher percentage of good quality tobacco suitable for the United Kingdom market.

If, in spite of this warning, it should be found when fairly reliable estimates are available of probable crop yield next season that the crop is in excess of the visible marketing requirements, the Government will, after full consultation with all the interests concerned, decide whether legislation is essential.

If it is found necessary to introduce this legislation the following principles regarding the method of disposal of the

surplus of the crop will probably be incorporated in such legislation:—

1. Those growers who produce above 80 per cent. of their 1933/34 production figure (*i.e.*, saleable production plus contribution to the Reserve Pool), may be required to hold such excess production at the sole discretion of the Government through the authority to be appointed to handle such surplus.

2. After the removal of such surplus, if the crop available is still in excess of the marketing requirements, then each grower may be called upon to contribute a defined percentage of his crop to the Reserve Pool, except that growers who produce 20,000 lbs. or less will be exempted from any contribution to such Pool.

3. In general the 1933/34 production by individual growers would be determined on the basis of their sales last season, but the Government would have the option of deciding such amount on the basis of the growers' contribution to the Reserve Pool this season.

4. Individual growers who for various reasons may consider themselves unduly prejudiced by the adoption of their 1933/34 production as the basis for their sales next year, may apply to the Minister for Agriculture, who will decide whether any variation from the defined datum can be permitted. Application to the Minister should also be made by all new growers.

In the event of any legislation being found necessary, it is not anticipated that it would affect the higher grades.

Quality not Quantity should be the motto.

Forestry and Tsetse Control in Northern Nigeria.—An interesting report appeared in a recent number of the *Empire Forestry Journal* on the above subject by J. R. Ainslie, B.Sc., Forest Officer in Northern Nigeria. Although the conditions there are somewhat different from those of this Colony, several points of fundamental importance are raised in the report, and the following extracts will undoubtedly prove of interest to all interested in this subject.

It should be emphasised that these notes apply only to the Northern Provinces of Nigeria, where the majority of forest reserves are of the Savannah type, with strips or patches of fringing forest locally called *Kurumis;* these Kurumis are often tsetse foci. In the Southern Provinces the tsetse problem is one of minor importance only.

One of the first steps in constituting forest reserves is forest settlement. This process of settlement concentrates the scattered population of outlying hamlets into large settlements on suitable, previously selected, agricultural areas. The inhabitants of these large settlements are capable of keeping, and do in fact keep, large areas round the settlements cleared by cultivation; they thus avoid man-fly contact to an extent which cannot be achieved in the case of small settlements. A further advantage these large settlements have is that the small hamlets rely on their water supply from water-holes, small streams, etc., generally surrounded by Kurumis, and in this way man-fly contact is almost continuous. In the case of large settlements the water supply comes either from constructed wells in the open or from water-holes, etc., cleared of surrounding forest; this clearing is easily carried out and maintained by the people of the larger settlements and, indeed, is often extended in the search for better agricultural soil, and so gradually the tsetse foci in the vicinity of the settlement become destroyed.

After the constitution of the forest reserves a general initial forest treatment known in Nigeria as "early firing" is applied. This early firing was originally introduced not as a tsetse control measure, but purely as an effective means of forest fire protection on areas where absolute protection could not be carried out.

The effect of early firing is that the grass and small brushwood is burned and the soil is scorched; the fire, however, is insufficient to kill tree growth and generally results in stimulating seeds, lying dormant in the soil, to germinate, and in exciting the production of root suckers from trees; these appear as a rule some few weeks after the fire.

It is at the end of the wet season and at the beginning of the dry season that *Glossina morsitans* has spread to its

greatest extent in the Savannahs, and accordingly the earlier the fire can be effectively carried out the greater is the destruction of the fly. By the time the grass is "bone-dry" in Nigeria the tsetse have all returned to the Kurumis, and so late fires, although much fiercer, have but little effect in exterminating the fly; the fly is no longer there.

Furthermore, the bird enemies of the tsetse are not yet all known, and it is not unlikely that some may commence nesting right at the end of the dry season, indeed many birds do; so that a late very fierce fire at that time might do as much harm as good, irrespective of the damage such a late fire would do to tree growth. In any case, there is a great risk of this.

Early firing has in Nigeria achieved very definite beneficial results; departmental records show that since its introduction a number of reserves, totalling in extent several hundred square miles, formerly tsetse infested and dangerous for grazing, have become largely tsetse-free and are now in demand as grazing reserves.

From a purely forestry point of view early firing has the advantage that after annual treatment for a few years marked forest improvement takes place; indeed, if the firing is properly carried out, the improvement appears to be almost as rapid as if the areas had been completely fire protected. Records of such areas taken in several reserves show a regular improvement of growing stock from approximately fifty stunted overmature trees to the acre to as many as 400 to 500, mostly young trees, to the acre in four to ten years' time.

So far the connection between *trypanosomiasis* and early firing has been discussed entirely from the point of view of tsetse extermination. It is not impossible, however, that early firing may produce other important results. I refer to the improvement in the grazing. Soon after the early firing has been carried out young shoots appear and are available as fodder for cattle. Normally at this time there is but little grass, and the cattle are half starved. If, however, they are allowed to graze in a reserve treated with early firing there is generally plenty of browsing fodder which can largely make up the deficiency in herbal grazing.

It is an admitted fact that cattle may be normally tsetse-tolerant or even tsetse-resistant, and it is reasonable to suppose that this tolerance or resistance may vary according to the quantity and quality of the diet obtainable. The popularity of grazing reserves among the Fulani cattlemen and the noticeable improvement in the stock grazed in these reserves leaves one to speculate whether the additional aboreal fodder which the ainmals obtain may not be of some special value. In this connection an experiment carried out by Mr. S. Lauchlan, Senior Conservator of Forests, appears to have some significance.

A herd of nine cattle were turned into the Zaria plantations. Adjoining the plantations is a tsetse infested kurumi. The cattle wandered at will through the plantations and the kurumi, and as four of these beasts were known to be infected with, and showed symptoms of *trypanosomiasis*, it is almost certain that at some stage of the experiment all became infected.

One of the purposes of the experiment was to see if the cattle infected with tsetse and subject to infection could survive the dry season with only forest grazing, and what would be their loss in weight during this time if they did survive. Weights were taken monthly and recorded by the Superintendent of Agriculture stationed at Shika, near Zaria. The weights showed an average increase in eight months (October to June) of 112 lbs.; or 14 lbs. per beast per month.

It is true the cattle were encouraged to eat as much forest fodder as possible, but considering that the figures were taken through the dry season when ordinary herbage is not available as fodder, the results are reasonable. Another noteworthy fact is that at the end of six months no cattle showed any symptoms of *trypanosomiasis;* this, needless to say, does not mean that they were cured, but together with the increase in weight may be taken as indicating an improved state of health. This, of course, is only one experiment, and a long series of these is necessary before real scientific significance can be attached to it. The experiment, however, opens a wide field of speculation. For example, it is possible that *trypanosomiasis*, although fatal in some cases, may in others only become so when aggravated by diet deficiencies; and how

common is the latter occurrence? The wide prevalence of the disease in the Southern Provinces and the comparatively rarely fatal results in that region among the native cattle, as well as the apparent tolerance of the diseases possessed by certain browsing animals, would appear to point to this end, and also to have a bearing on Sir Frederick Keeble's theory that the spread of insect borne disease in Africa is largely aggravated by soil deterioration.

Sweet Potato Tubers.

Supplies of the best varieties of the above are available from the Agricultural Experiment Station, Salisbury, at 7s. 6d. per petrol case, f.o.r. any station or siding in Rhodesia. The tubers are treated with lime before despatch to ensure delivery in good order.

The following varieties are available and recommended:

Early Butter, Linslade — Highest yielders of tubers.
Calabash.—High yield of tops.
Early Butter, Red Nansemond, Yellow Jersey — Best table varieties.

Information concerning the method of sprouting the tubers was published in the September, 1929, issue of the *Rhodesia Agricultural Journal.*

Commence sprouting after danger of frosts is past. Three cases of tubers will supply slips for planting one acre.

Cheques should be made payable to the Department of Agriculture, and should accompany orders.

Salisbury Agricultural Experiment Station

ANNUAL REPORT, 1932-33.

By H. C. ARNOLD, Manager.

(*Concluded.*)

THE EFFECT ON THE FOLLOWING CROP OF PLOUGHING UNDER MAIZE TRASH.

It is well-known that applications of well-rotted farmyard manure, derived mainly from maize stalks, have a beneficial effect on the crop-producing power of cultivated land, and because of this, it is generally inferred that the ploughing under of the unrotted material remaining on the land after the maize crop has been reaped will likewise raise its productive capacity. It has been observed, however, that unrotted farmyard manure sometimes exerts a marked depressing effect on maize yields, and in Europe it has been found that, although legumes are not affected, cereals following the ploughing under of wheat straw do not thrive as well as on land from which the straw is previously removed.

It is the usual practice in this Colony to allow the farm animals to graze on the maize lands after the grain has been removed, and in such cases, only negligible amounts of trash remain, but on those farms where mechanically propelled implements are largely used, or where there are few cattle, a large amount of trash will remain on the land, and the queston will arise as to whether its incorporation with the soil in its raw state is likely to be beneficial or otherwise to the following crop.

In order to obtain information on this point experiments were commenced during the season 1930-31 when dressings of ½ ton per acre and 1 ton per acre of maize trash were ploughed under, after first breaking up the stalks with a silage cutter to ensure a more even distribution of the material. The smaller amount is probably as large as that usually available for ploughing under, and the larger amount would be equal to the total fodder remaining after an eight to ten-bag crop of grain had been removed from the field. The experiment plots were arranged in chess-board pattern, with an untreated control plot for each treated plot. Each dressing was applied on four plots, and one half of each plot was planted with maize, and the remainder with ground nuts. The differences between the yields of the treated and the untreated plots was so small as to indicate that the treatment was ineffective. In the following season the ½ ton dressing was omitted and 8 plots were dressed at the rate of 1 ton of trush per acre, while 8 control plots were included. Maize and ground nuts were again planted. In the following tabulation the yields in lbs. of each 1/64 acre plot are shown.

Yields in lbs. of (a) Maize, (b) Ground Nuts per 1/64 Acre.

MAIZE.		GROUND NUTS.	
One ton per acre Maize trash.	Control. No. trash.	One ton per acre Maize trash.	Control. No trash.
54	52	14.0	14.0
42	28	11.5	14.5
53	52	16.5	11.0
35	42	19.5	18.0
61	75	18.0	24.5
59	34	18.5	18.0
71	50	23.5	20.0
48	23	23.5	24.0
423	356	145	144

These results indicate that the treatment increased the yield of maize by 19%, *but statistical analysis of the plot yields show that these results should be regarded with reserve.* The treatment appeared to have no effect whatsoever on the ground nut crop.

During the season under review the plan was altered to include four plots which received a dressing of three tons per acre of trash, and four to which one ton per acre was given. For each treated plot an adjacent untreated control plot was provided.

Yields in lbs. of (a) Maize, (b) Ground Nuts per 1/64 *Acre.*

MAIZE.				GROUND NUTS.			
One ton per acre Maize trash.	Control. No trash.	Three tons per acre Maize trash.	Control. No trash.	One ton trash.	Control. No trash.	Three tons trash.	Control. No trash.
37	35	44	49	25	22	25	24
52	42	41	41	23	19	17	22
57	51	46	51	15	18	18	19
54	55	53	63	18	19	21	16
200	183	184	204	81	78	81	81

The difference between the yields of the treated plots and those which received no maize trash are so small as to admit of only one conclusion, *viz.*, that the treatment had on effect.

It is seen therefore that dressings of maize trash equal to ½ ton, 1 ton and 3 tons per acre respectively, have neither increased nor decreased the productive capacity of the land.

One Ploughing versus Two Ploughings for Maize Production.—Cross-ploughing in addition to the preliminary autumn or winter ploughing is customary in some countries, and with the object of investigating this question under local conditions, this series of experiments was commenced.

With these plots all the land was ploughed, rolled and harrowed during the winter months. After soaking rains had fallen the area was divided into four blocks, each of which was sub-divided into two, one of each pair being further dug over by hand, while on the other this process was omitted. The second working being by hand, the work was probably performed a good deal more thoroughly than it would have been by the plough and better results might therefore be expected.

The following table shows the yields over four seasons.

Yields of Maize in Bags per acre.

Season.	Block 1. Ploughed Once.	Block 1. Ploughed Twice.	Block 2. Ploughed Once.	Block 2. Ploughed Twice.	Block 3. Ploughed Once.	Block 3. Ploughed Twice.	Block 4 Ploughed Once.	Block 4 Ploughed Twice.	Mean of 4 Blocks Ploughed Once.	Mean of 4 Blocks Ploughed Twice
1929-30 ...	21.48	22.24	20.76	22.52	21.72	20.84	19.76	22.36	20.93	21.99
1930-31 ...	13.20	13.68	16.70	15.50	13.68	12.80	13.44	15.12	14.26	14.28
1931-32 ...	15.84	17.04	16.88	15.28	14.40	16.64	9.44	14.00	14.14	15.74
1932-33 ...	7.12	6.02	5.60	5.24	5.28	6.14	4.40	3.92	5.60	5.33
Totals over 4 seasons	57.64	58.98	59.94	58.54	55.08	56.42	47.04	55.40	54.93	57.34

These returns indicate a gain of 0.6 of a bag per acre per annum in favour of ploughing the land twice, but reference to the individual plot yields shows that, owing to the wide variation between the yields of plots treated alike, it is doubtful whether the indicated difference is really due to the treatment.

These trials seem to confirm the general opinion that one thorough ploughing followed by adequate surface working is sufficient, and that a second ploughing is not likely to prove economical unless it is done for specific reasons, such, for example, as to destroy weeds, or turn in fertiliser or manure, or after green-manuring.

Catch Crops on Green Manured Land.—Enquiries have been received from farmers who wish to grow a catch crop on their land immediately after a green manure crop has been ploughed under. Their only objection to the practice of green manuring is the absence of any cash return from the treated land until the following season's crop has been harvested, and the need for a quick-maturing crop which will yield a return for the expense incurred during the current season has therefore arisen.

The chief handicap to the production of two succeeding crops in one season is the limited period of 4½ to 5 months during which rain may be expected, and further, the irregularity with which it falls within that period. When the sowing of a second crop is contemplated, therefore, it is obviously necessary to sow the green manure crop as early in the season as possible. In the trials made at this station the sunn-hemp

seed has been sown before the advent of the rains, and it has been found that the crop is usually ready to plough under about the middle of the following January. The catch crops were sown as soon as possible after the ploughing operations were completed, and consisted of haricot beans, ground nuts, cowpeas, sunflowers, S.E.S. oats, hull-less oats and safflower.

In the season 1931-32 copious showers of rain fell at fairly regular intervals for a period of 14 weeks after the catch crops were sown, with the result that, all excepting the safflower, succeeded fairly satisfactorily. During the season under revivew no rain fell for three weeks after the seed was sown, and poor stands resulted. Cutworms attacked the young plants and reduced the stands still further. The results over the two-year period 1931-33 may be summarised as follows:—

Haricot Beans.—In the first season this crop gave the satisfactory yield of 738 lbs. per acre of seed beans, but in the second season, owing to drought and attacks of cutworms, stem maggots and stem weevils, the crop failed to give an economic return.

Ground Nuts.—These appeared to thrive moderately well, and proved very drought-resistant, but the nuts did not ripen properly, a large proportion of them being immature when their foliage was killed by frost. In the first season 468 lbs. of nuts per acre were obtained, and in the second season 486 lbs. per acre. It was evident that this crop required a longer period for its development than is available when it is sown so late in the season, and it is not suitable for use in this way.

Cowpeas.—The "Iron" variety was sown, and in the first season a fairly good crop was reaped, but the second season's crop failed. The cowpea crop is seldom satisfactory at this Station, owing to insect and fungus disease attacks, but the growth produced during the first season indicated that in sand veld areas where the crop thrives, it could be grown successfully as a fodder crop following the ploughing under of the green manure crop.

Black-seeded Sunflowers.—The remarkable hardiness of this crop was demonstrated in these trials. In the first season

the stalks reached to over seven feet high, thus providing a heavy crop of fodder. The yield of seed was less than would be expected from an earlier sown crop, as it amounted to 500 lbs. per acre only. In the second season the stand was reduced by drought and insects, but the plants reached to 6 feet in height, showing that even in so unfavourable a season increased fodder supplies could be obtained by using sunflowers as a catch crop after the green manure had been ploughed under.

S.E.S. Oats.—In the first season these oats produced a very good crop of fodder, though the grain was not as plump as when it is grown under more favourable conditions. The crop was cut in June and a yield of more than two tons of hay per acre was obtained. In the second season the stand was reduced by drought and cutworms, but the remaining plants proved strikingly drought-resistant, and 1,400 lbs. per acre of hay was obtained. The growth made by this crop indicated that on land which retains moisture for a few months after the normal period of precipitation, this variety of oats will prove of great value to stock farmers who require green fodder for soiling or grazing during the autumn and winter months.

Hull-less Oats.—This variety proved less thrifty than the S.E.S. oats, only producing about half as much fodder as the other kind. For this reason they are less suitable for use in this manner than the more robust S.E.S. variety.

It appears, therefore, that of those tested, the haricot bean is the only crop which can be expected to yield a normal crop of seed when sowing takes place during the latter part of January, and is preceded by a green manure crop; but cowpeas, sunflowers and S.E.S. oats yield very useful crops of fodder which can either be grazed off in the autumn months, or converted into hay or silage for feeding later. It is possible, however, that kaffir beans or cowpeas might also produce a seed crop worth reaping on many farms in the country, which are not infested with the stem maggot or bean stem weevil, and it can be recommended as being worth while testing out for this purpose on a small scale at first. It is known that

several farmers have obtained a good yield of kaffir beans after a previous early crop of the same variety has been ploughed under in early January.

Ground Nut Fertiliser Trials.—It is well known that nearly all crops make beneficial use of chemical fertilisers, and because of this the ground nut crop might reasonably be expected to respond to applications of fertiliser, also particularly when it is grown on land, the fertility of which has been depleted by continuous cropping.

With the object of finding a method of increasing the yield of ground nuts, by the use manures, trials were commenced in the season 1925-26 when farmyard manure was used. It was found, however, that the yield of nuts was not increased sufficiently to justify the use of manure. Since that date five different series of experiments have been laid down, which have included the use of lime and chemical fertilisers, but in no case has the increased yield of nuts exceeded the cost of the fertiliser by a margin wide enough to justify the practice.

During the season under review the fertiliser scheme was restricted to the use of superphosphate, but the differences in amount used, and the method of applying it, were introduced. The treatments were as follows:—

(1) 200 lbs. per acre superphosphate broadcast.

(2) 200 lbs. per acre superphosphate applied in the seed drills.

(3) 400 lbs. per acre superphosphate applied in the seed drills.

(4) No fertiliser.

The plots were arranged in the form of a 4 x 4 Latin square, and on one half of each plot the Valencia variety was planted, while the other half was planted with the Masumbika variety, but owing to the early cessation of the rains the latter variety produced a very poor crop.

The results obtained with the Valencia nuts are given below.

Yield in lbs. of Ground Nuts and Hay per Plot of 1/32 acre.

200 lbs. per acre Supers Broadcast.		**200 lbs. per** acre Supers in drills.		**400 lbs. per** acre Supers in drills.		No fertiliser.	
Nuts.	Hay.	Nuts.	Hay.	Nuts.	Hay.	Nuts.	Hay.
42	34	43	36	45	40	42	26
63	58	63	57	54	83	63	58
49	41	62	61	59	65	59	40
58.	48	58	62	55	74	56	41
212	181	226	216	213	262	220	165

These returns support the results of previous experiments by indicating that the fertiliser dressing did not increase the yield of nuts, but there is seen to be a considerable increase in the yield of hay. The cost of the increase was about £4 10s. 0d. per ton of hay, so it is still doubtful whether expenditure on fertiliser for this crop would be justified, unless the soil is at a very low ebb of fertility.

Ground Nuts Variety Trials.– Owing to its very low yields the strain of Java nuts included in these trials last year were omitted during the season under review. The varieties under trial consisted of Valencia, Virginia bunch, Jumbo and Bombay, and their yields are given below.

Yields of Ground Nuts in lbs. per Plot of 1/16 acre.

Valencia. (Spanish Bunch)	Virginia bunch.	Jumbo.	Bombay.
54	93	96	91
58	115	92	101
62	100	96	86
46	101	101	94
220	409	385	372

These trials for several years have shown that much heavier yields of ground nuts may be obtained from the Virginia bunch variety than from the Valencia, and this year the crop of Virginia bunch is nearly twice as heavy as the other. Not only is the yield of nuts heavier, but they contain a higher percentage of protein than the common variety, and in addition heavier yields of hay are secured. ***It will be seen therefore that when the whole of the crop is to be used on the***

farm there is a decided advantage in growing the Virginia variety instead of Valencia. Although the Jumbo and Bombay varieties produce large crops of nuts, their procumbent habit of growth increases the cost of weeding and harvesting the crop so much as to offset any advantage they may possess through their cropping capacity. This season, however, their yield was not as large as that of the Virginia bunch, so they appear to possess no particular merit.

Soya Beans Trials.—Owing to the continuous lower yields of both fodder and seed a number of varieties were excluded from these trials this season, but a number of promising hybrid strains, arising from selections made here, were included, as well as two non-shattering varieties which have been obtained through the courtesy of the Department of Agriculture of the Union of South Africa and Mr. Laurie, of Concession. Although these non-shattering varieties proved satisfactory as regards the retention of their seed, their yield of fodder and seed was less than half of that of our standard strains, and for that reason their general cultivation cannot be recommended. With a view to combining the desirable characteristics of the high producing with the non-shattering strains they are being inter-bred.

Sunnhemp.—The value of this crop for green manure is widely known, but for a number of years its low yields of seed had caused the price to be so high that many farmers were obliged to use other crops in place of it, and investigations were therefore undertaken with the object of finding means of increasing the seed yield. Very promising results were obtained from the establishment of pure strains from individual plants which appeared to possess the desired characteristics, but the introduction of an entirely new Indian strain seems to have brought the solution of the seed production problem much nearer. It was first grown in the season 1930-31, and from that time it has produced heavy crops of seed each year. Not only has its crop of seed exceeded that of the common variety in lbs. per acre, but owing to its smaller size a given quantity of the new strain will sow twice as much land as an equal quantity of the common variety. The new variety will, therefore, enable farmers to produce their required amount of seed for green manure at half the

cost incurred when the common kind was grown. The new variety is called "Somerset," after the name of the farm of Mr. A. S. Laurie, of Concession, who brought the original seed from India. Small quantities of seed of this variety were issued to a number of farmers at the commencement of the season, and in nearly every case favourable results were reported. Besides producing seed more freely than the common variety, the new kind is also slightly more vigorous, and resistant to leaf spot and other diseases.

Sunn-hemp Fertiliser Trials.—With the object of investigating the effect of various soil treatments on the seed production of sunn-hemp, a series of trials were commenced during the season under review. The treatments are given below and the quantities are expressed in pounds per acre.

(*a*) 200 lbs. superphosphate.

(*b*) 2,000 lbs. agricultural lime.

(*c*) 2,000 lbs. agricultural lime, plus 200 lbs. superphosphate.

(*d*) Control. Nor fertiliser or lime.

The plan of the experiment was a 4 x 4 Latin square, and the sunn-hemp seed was sown on November 25th, 1932. The result of the trial is shown in the following table.

Yields of Sunn-hemp Seed in lbs. per Plot of 1/32 acre.

	Super only.	Lime only	Super and Lime.	Control.
	21	11	19	17
	32	28	34	25
	51	40	38	32
	33	29	39	33
Total of four plots ...	137	108	130	107 SE 8.775
Yields per acres. Bags of 200lbs.	5.48	4.32	5.20	4.28 SE 0.351

These trials show that where lime alone was applied the yield was no heavier than that of the untreated plots, but

there was a marked response from the plots which received superphosphate, the increase being fully 200 lbs. per acre.

The plots which received the fertiliser were sub-divided into two halves, on one of which the fertiliser was broadcasted on the surface and harrowed in, while on the other the fertiliser was applied in the seed furrows. The yields of seed from the various plots did not reveal any difference in favour of either method of applying the fertiliser.

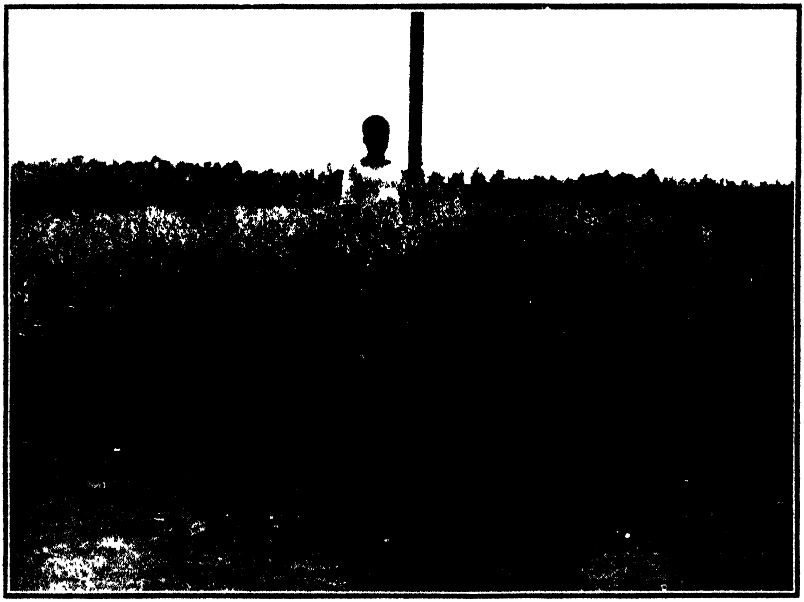
The opinion has been expressed that the heaviest yields of seed are obtained from the soil of low fertility, and that the fertile soil conduces to luxuriant growth of stalks but low yields of seed. That this is not always the case was shown this season, when land which had been dressed with 16 tons per acre of farmyard manure yielded as much as 1,710 lbs. of seed per acre.

The experiments conducted at this Station indicate that climate conditions, the chief of which is probably the incidence of the rainfall, have a greater effect on the seed production of the common sunn-hemp than methods which can be artificially applied with the object of increasing the yield. The Somerset variety has produced comparatively heavy yields each season since its introduction three years ago, and it appears to be less susceptible to seasonal influences than the common variety.

Summer Oats.—The stall feeding of cattle which is now being more generally practised has increased the importance of fine-strawed cereal crops, which are suitable for cultivation during the summer months, and subsequent conversion into hay or silage. The Kherson and S.E.S. oats recently introduced by this Department are particularly suited for this purpose, and their cultivation is extending among farmers who practice crop rotation and the feeding of livestock.

The work of the Station this season included the testing of a number of strains of these two varieties, with a view to the isolation of those most suitable for summer cultivation by reason of their resistance to rust and giving heavy yields of fodder. Among the S.E.S. strains the one known as No. 52 again proved somewhat superior to the others, and in future it will be considered the standard strain.

3 7 bags per acre of Haricot Beans (White ex Kellaway) after Sunnhemp ploughed under in January



S.E.S. Oats after Sunnhemp ploughed under, 1932.

A few years ago attempts were made to increase the rust-resisting ability of the hull-less oats by hybridisation with our best strain of Kherson oats. Although those efforts were not successful in effecting permanent improvement in the hull-less variety, a hull-ed strain having much larger and plumper grain than the Kherson was obtained. It proved very rust-resistant for a few years, but in common with all the other strains it has since developed a certain amount of rust when grown during the summer months. The rust attacks have not appreciably lessened the yields of fodder, but they have reduced the grain yield somewhat. This variety resembles the Kherson in its habit of growth and time required to reach maturity, but the grain is larger, and the yield heavier than that of the parent variety. It is very suitable for those who require a crop which matures more quickly than the S.E.S. oat, and as it thrives well during the winter months, it would be advisable for those farmers who have the facilities to grow their seed crop at that time of the year, and to utilise the whole of the summer crop for hay.

Pyrethrum.—During recent years investigators have found new methods of using the insecticidal properties of this plant, so that instead of its being used in the form of powdered flowers almost entirely, extracts are now made which are used in liquid form in houses, gardens and stables or wherever a non-poisonous insecticide is required. Although the active principles of pyrethrum are highly toxic to insects, they are harmless to mankind and warm-blooded animals, thus forming an almost unique combination of qualities. For this reason it can be used in sprays against insects attacking fruit trees at times when it would not be possible to use arsenical or other poisonous sprays. There is a possibility of future investigations showing that pyrethrum can be used in this Colony and neighbouring States against insects which attack citrus and deciduous fruits which at present are difficult to control, so that a local demand of some importance may arise.

This wider range of usefulness has increased the demand for the pyrethrum flowers, and with the object of finding whether the crop could be grown under local conditions, seed

of *Pyrethrum cinerariæfolium* was obtained through the courtesy of the Director of the Plant Pathological Laboratory of the British Ministry of Agriculture.

That sown in nursery beds in September, 1931, produced plants of a suitable size for transplanting during the following December. A part of this stock was planted in beds which could be irrigated, and the remainder was planted in the open where the plants received no artificial supplies of water.

Irrigated Pyrethrum.—A few of these plants produced flowers before they were a year old, but the main crop was obtained in October and November, 1932. About 25 per cent. of the plants failed to produce any flowers at that time. The yield of dried flowers from this first main crop was 55 lbs. per acre, a few flowers being produced throughout the summer and autumn. These were not collected from the trial plots, but it is estimated that they would have more than repaid for the cost of collection if the crop was being grown on a commercial scale. The plants were not supplied with water during the months of June and July, but in August, 1933, a dressing of farmyard manure and irrigation was recommenced, with the result that, during November and December, a good crop of flowers was produced. These were collected twice weekly, and the yield of dried flowers obtained during that period was at the rate of 230 lbs. per acre.

Dryland Pyrethrum.—The plants in these plots were spaced about 36 inches by 18 inches apart, or twice as far between the rows as those under irrigation, in order to allow of the use of a cultivator between the rows and to assist the plants to withstand the effects of the long winter drought. A number of plants succumbed to a wilt disease soon after they were transplanted, and it is assumed that the disease was contracted in the seed bed, in which case it could have been prevented by the sterilisation of the soil before the seed was sown. With the exception of these the plants appeared thrifty, and they resisted the autumn and winter drought remarkably well. During August, 1932, exceptionally heavy rains, totalling two inches, were precipitated, and thus the plants were enabled to continue their growth until the regular rains arrived in November. Flowers were produced throughout the month of

January, 1933, and they were collected twice weekly and dried. The total weight of these flowers was at the rate of 80 lbs. per acre.

The crop on dry land appeared to thrive satisfactorily, but the fact that copious showers of rain fell over a period of three months after it was planted and a further two inches fell in August should not be lost sight of.

It would appear that there is every reason to believe that the crop could be grown successfully under irrigation, but whether its cultivation would be profitable depends largely on the number of years the plants remain productive and the price obtained for the flowers. The overseas price for the dried flowers varies from 3d. to 1s. 3d. per lb., and at the present time it is about 1s. per lb. The local price for the powdered flowers is 4s. 6d. per lb., and this is chiefly used for insect powder.

At the present time about 70 per cent. of the world's supply is grown in Japan where, after a small yield in the second year, the plants are expected to yield about 500 lbs. per acre in the third year and 180 lbs. per acre during their fourth, fifth and sixth years, after which the yields decline.

From experience acquired to date the cultivation of the crop appears comparatively simple. If the seed is sown during September in beds of sterilised soil as is customary for tobacco, plants three or four inches high will be ready for planting out during the following December. While it is doubtful whether the crop will succeed on dry land, it is thought that it may prove successful on irrigated land, and possibly on drained vlei land.

Cattle and Beef Survey.*

A summary of the production and trade in beef and veal in the British Empire and foreign countries has recently been prepared by the Intelligence Branch of the Imperial Economic Committee.

The summary and conclusions of this report are of particular interest to stock farmers in this Colony and are here reproduced in a condensed form.

(1) **Cattle Population.**—The cattle population of the chief cattle raising countries has, on the whole, remained stationary since the year 1930. There has been a decrease of some 5,000,000 head in the chief exporting countries. 1,000,000 of this decrease is shown by British countries, largely due to the drought in the Union of South Africa in 1933. The total decrease is, however, more than made good by an increase of some 9,000,000 head in the chief importing countries during the years 1930 to 1933.

In this connection it is important to note, however, that in the majority of countries in which increase of cattle numbers have occurred, the increase has been chiefly in dairy herds. Such increased interest in dairying inevitably has deleterious effects on the quality of the beef produced, and it is probable that the beef producing capacity of the chief producing and consuming countries has decreased appreciably, though still quite adequate to respond rapidly to any likely increase in the demand for beef.

(2) **The World Trade in Beef.**—The world trade in beef has shown a definite decline since 1930. This is largely due, on the one side, to the building up of the herds decimated by the war, and secondly, to a general system of quotas and tariffs, which have the effect of diminishing the aggregate trade in beef and cattle and are likely to prevent any expansion of the trade in the near future, if not to diminish it further.

*Cattle and Beef Survey. Prepared by the Intelligence Branch of the Imperial Economic Committee, June, 1934. London: Printed and Published by His Majesty's Stationery Office. Price 5s. net.

The world's exports of beef and tinned meat have indeed shown a substantial decline since 1925. In that year they aggregated 1.2 million tons, as compared with less than half that amount before the War, and fell to between 700,000 *and* 800,000 *tons in* 1932 *and* 1933. Almost the whole of this decrease between 400,000 and 500,000 tons occurred in frozen beef, which fell from 630,000 tons in 1925 to 200,000 tons in 1933, the small balance being accounted for by the fresh and salted categories. Chilled beef exports, almost the whole of which go to the United Kingdom have, on the whole, remained fairly steady, although there was an upward trend in 1926 and 1927, and much the same is true of tinned meat. Thus, the outstanding feature of the world's trade in beef is the substantial contraction in the market for frozen beef, which it is important to note, is the main form of export of beef from British Empire countries. This factor lends particular interest to the efforts at present being made by those countries to enter the chilled beef market.

The most important British Empire countries exporting beef, namely, Australia and New Zealand, have been greatly handicapped by their distance from the principal markets and hitherto it has been necessary to ship the whole of their beef in the frozen state or in tins, the risk of chilled meat deteriorating during the long journey through the tropics being so great as to prevent such shipments from being attempted on a commercial scale. Recently trial shipments of chilled beef have been made from the Southern Dominions and Southern Rhodesia, and have raised hopes of an introduction of a chilled beef trade on a commercial scale in the future. Chilled beef, under normal marketing conditions, always commands prices which are considerably above those prevailing for frozen beef, while the demand for frozen beef in the United Kingdom—the principal market—has been steadily decreasing. In view of recent developments it seems probable that within the next few years beef will be brought to Europe from Australia, New Zealand and South Africa in a condition to compete on favourable terms with South American chilled beef, and if this materialises Empire countries will be in a position to play a much greater part in the world beef trade than they do at present.

(3) **Prices.**—The inflated prices of the War period, during which prices had more than doubled, collapsed in 1920, largely as a result of monetary causes, and by 1923 prices had fallen to from 40 to 60 per cent. of the peak reached in 1920. Since 1923 prices of all three categories of beef—fresh, chilled and frozen—have tended to fluctuate together, particularly the two latter varieties, and until 1930 were well maintained. Prices of all categories fell heavily in 1931, and continued to decline throughout 1932. There was a halt in the downward movement in 1933, but no marked changed in trend is yet in evidence.

Frozen beef has suffered most severely, and fresh beef least of all, and this appears to indicate some transference of demand to the better qualities of beef induced by the relatively low prices prevailing. Throughout the post-war period until 1927, there was a marked rise in the price margin of chilled beef over frozen despite the largely increased supplies of the former, and the margin between fresh and frozen prices also widened. This was due largely to the change of demand from the cheaper to the dearer classes of meat. Between 1927 and 1930 supplies of chilled beef decreased, and as a result there was a rise in the price trend of this class, and the margin between fresh and chilled again narrowed. After 1930 the price margin rose but fell again in 1933.

Prices are at present at very low levels compared with those ruling prior to 1931, but except in the case of frozen beef are still above those prevailing before the War, and higher than the general level of commodity prices. In spite of the adoption by Great Britain in 1932 of restrictions on imports of chilled meat and of frozen meat from foreign countries, aggregate supplies of beef increased slightly in 1933. In consequence there was no upward movement in prices in 1933, or the early months of 1934, and indeed, in the case of fresh beef the trend has continued downward.

Beef prices have, on the whole, offered a strong resistance to the downward pull of the depression, but while there are cheaper meat and non-meat substitutes, it seems unlikely that any considerable and sustained rise in prices can be looked for in the absence of an increase in purchasing power for expenditure on foodstuffs generally.

(4) **Conclusions.**—There has been a definite decrease during the past six years in the world's *per capita* consumption of beef and veal partly as a result of the substitution of mutton and pork for beef and veal, and partly as a result of the decline in the consumption of meat in general. This downward movement has been accelerated during the last few years by the world depression which, consequent upon the diminution in incomes, brought about a substitution of cheaper non-meat foods for meat. It seems likely that this latter factor has now almost exhausted itself. Indeed, in certain important meat-consuming countries the demand appears to be increasing, and meat consumption taken generally should not fall to much lower levels.

It is clear, however, that the beef-exporting countries will have to reconcile themselves for some years to come to a diminution in the overseas demand for their product, and it is possible indeed that the greatly restricted demand already ruling from outside sources may suffer an even further decline, as the herds in the importing countries continue to grow. In this connection the adoption by the United Kingdom of a quota policy is of outstanding interest to the exporting countries. The United Kingdom is by far the largest importer of beef and veal and cattle in the world, and although the proportion of the world's exports of beef and cattle now taken by her is somewhat less than before the War, it has been increasing almost consistently since 1925, and exceeded 80 per cent. of the exports of beef and veal from all countries in 1933, and about 50 per cent. of the cattle exports. The measures taken by the United Kingdom since 1932 to reduce her dependence upon imported, and particularly non-Empire supplies of beef, are thus of vital importance to the world's cattle and beef industry. It was anticipated that the restriction of foreign supplies would, by raising the level of beef and cattle prices, assist livestock raisers both in the United Kingdom and the Dominions. But although prices have, as a result of the measures adopted, probably been prevented from continuing their drastic fall, they have not materially improved, and it seems that a rise adequate to the needs of the case will not occur while incomes remain for the most part at their present low levels.

Recent developments are encouraging the efforts of the cattle-raising industry in the Southern Dominions and Southern Rhodesia in the expectation that they will enjoy in the future a larger share of the chilled beef trade which is at present almost exclusively carried on between the South American countries and the United Kingdom. Successful experimental consignments from all these Empire sources have already been made, but before the trade can assume substantial proportions much remains to be done. Chief among the problems awaiting solution by the organisers of this trade are the more rapid maturity and up-grading of the stock, and their efficient transport to the abattoirs and from the abattoirs to their final destination. The former problem will be the more difficult to solve, but its early recognition will result in the adoption in good time of the measures indispensable to success.

It is clear therefore that the United Kingdom will have to rely upon the South American countries, particularly Argentina, for the bulk of her imported beef supplies for some years to come, as the chilled article is very much superior to the frozen, and in much greater demand. It is almost certain that frozen beef will come to play a less and less important part in world trade, and until Empire supplies can be mainly transported in the form of chilled beef their share of total world trade is likely to remain small.

During the next few years it is very unlikely that there will be any radical alteration in the world beef situation. The South American countries will almost certainly continue to provide the bulk of the world's exports and the United Kingdom will continue to absorb them. Any notable increase in demand is unlikely unless general economic conditions materially improve, but in any event the principal producing countries are quite capable of satisfying it after a short period under favourable conditions of demand. Moreover, the nature of the cattle and beef industry, which requires a lengthy period of time for the up-grading of stock and the organisation of slaughtering and marketing of the product, precludes any of the present minor sources of supply from appreciably increasing their share of the world trade in the near future.

Mycological Notes.

SEASONAL NOTES ON TOBACCO DISEASES.

7. SPRAYING IN SED-BEDS AND LANDS.

By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A.,
Senior Plant Pathologist.

The article which I wrote in this Journal last year (1) on the need for improvement in spraying methods has evidently penetrated into the wilds with more speed than usual, for I have recently been inundated with enquiries regarding pumps and spray fluids. I am therefore writing a few notes which I hope will give tobacco growers the information which they require in purchasing equipment for seed-bed spraying. Whilst the scribe's mood is upon me I think it advisable to give a short account of what has been done in the direction of field spraying and what the prospects are for this new departure, but first of all, by way of introduction, it would be as well to describe recent work on seed-beed spraying.

PROTECTION OF SEED-BEDS.

During the past two seasons close watch has been kept upon the effects of spraying on disease control in the beds. Last year a controlled experiment was carried out to test the value of three different fungicides against angular spot, wildfire and frog eye. New land was chosen at the Tobacco Research Station, Salisbury, for the seed-beds and no standing tobacco was present within miles of the site. New bricks and seed-bed cloth were used, the beds being burnt in the usual way. Sterilised seed was employed and the beds were watered from a borehole.

Three brands of spray material were used, namely, "Capex" Dry Bordeaux, "Lunevale" Dry Bordeaux and "Buisol" liquid colloidal copper, and one bed was left unsprayed as a control. The plants were purposely raised

under adverse conditions, being sown thickly and deprived of readily available nitrogen in order to favour infection by the frog eye fungus. Spraying was commenced as soon as the leaves of the majority of seedlings had attained the size of a shilling piece and continued at approximately weekly intervals until transplanting time. Five sprayings in all were given.

It was found that the Bordeaux mixtures at a strength of 4-4-50 killed off many of the very small seedlings at the first spraying and caused some slight scorching of the largest leaves on the bigger plants. The killing of the seedlings was regarded as advantageous in that the beds were thinned somewhat without handling and the number of weakly plants reduced. The slight scorching of the larger leaves was not found to be detrimental to growth and did not develop into serious lesions which might afford entry for disease germs. It was therefore deemed unnecessary for the spray fluids to be reduced in strength as is done in Australia, (2) under similar circumstances.

Without going into a lot of detail (which will be done at some other time) it can be stated that after the fourth spraying no disease could be detected in the sprayed beds, whilst the control was riddled with frog eye. It therefore appears that frog eye infection is air-borne, but can be entirely controlled by adequate spraying. There has been a good deal of doubt on this point in recent years and further experiments will be carried out to confirm this work.

Two days after the fourth spraying all the beds were inoculated, by means of an atomiser, with a mixed suspension of angular spot and wildfire bacteria in sterilised beef broth. Three days later the treated beds were again sprayed with fungicide and the control bed with plain borehole water. A week later transplanting began.

By this time many of the seedlings in all beds were very chlorotic (yellow), some of the lower leaves resting on the ground being quite bleached, yet only one disease lesion, a frog eye spot, was found in the sprayed beds. The control, on the other hand, contained very few, if any, healthy plants; nearly all leaves showed at least one frog eye spot, but usually several, and a number of angular spot and wildfire lesions were observed.

The subsequent history of these plants showed that no angular spot or wildfire was present in the plots set out with sprayed plants, but that both diseases were present in plots planted from the control beds. Frog eye did appear later in all plots, but the weather conditions were such that the final results of the field tests were inconclusive and do not warrant publication just yet.

But consider more carefully the seed-beds. Why was it found possible to raise unthrifty plants to the setting out stage in an unblemished condition when it is well known that such plants are highly susceptible to frog eye? There can be only one reason, namely, that spraying as carried out during the experiment does eliminate the disease. Why is it then that so many growers declare frog eye to be uncontrollable? Again, to my mind, there is only one reason. Seed-bed spraying is not carried out in a correct manner. In the majority of cases to which I refer, it is not possible for the grower to do the job properly, because he does not possess suitable equipment, and it is useless to spray with fungicides unless the right type of pump and nozzle is used and the fluid correctly prepared. Half measures are a waste of time and money, and only result in failure and disappointment.

Now for a few details. Let me stress once again the uselessness of locust pumps for seed-bed spraying. By employing such a pump you may save 25s. at the begining of the season and lose £250 at the end, so make up your minds to buy the best type of pump now—and look after it! A bucket pump is quite suitable for seed-beds, provided that it is fitted with 10 ft. of rubber piping, a brass tube extension of at least one foot in length, and a fine *spraying* nozzle. Most pumps are supplied with three sizes in jets, namely, plain jet, lime-washing nozzle and spraying nozzle, but are fitted with a 3 foot length only of rubber hose. Insist on replacing this short length by a 10 foot piece; it will only cost you a shilling or two more. Furthermore, do not accept a lime-washing nozzle alone with your outfit, make sure that a much finer jet is provided.

If you wish to use a hand pump instead of a foot pump, the same advice regarding nozzles and hose is applicable.

Having obtained suitable equipment to give a good mist-like spray, you must decide upon what fungicide you will use. I recommend copper compounds, of which there is a fair choice to be had in Salisbury.

Home-made Bordeaux Mixture.—You may use home-made Bordeaux, the preparation of which has been described fully in the Departmental handbook "Diseases of Tobacco in Southern Rhodesia," obtainable from the *Herald* Store, Salisbury, price 4s. 4d., postage paid, and in this *Journal* (3). If you decide to use this fluid, the following suggestions may be of value. It has been found practicable to employ iron drums (obtainable for 7s. 6d.) in making up the bulk solutions, provided that the inside is first of all well cleaned and then painted with "Bitulac," graphite paint, or similar inert protective covering. Such iron drums are also useful in another direction. Much difficulty is experienced during the rains in protecting unslaked lime from the action of the moist atmosphere, so that it is not uncommon for bags to burst in transit and the lime (or part of it) to arrive in an air-slaked condition. Such lime is unsuitable for making Bordeaux Mixture and should never be employed. To overcome this difficulty an iron drum should be used for transport. A hole should be cut in one end and an airtight lid, which can be screwed down tightly, be fitted. The drum may be filled with lumps of quicklime **(only the best white lime must be used)** which some firms in Salisbury will pick out at a cost of 1s. extra per bag. Good unslaked lime is such an essential ingredient that the small extra freight charged on the drum is well repaid by increased efficiency of the spray.

Having prepared the Bordeaux Mixture with best grade bluestone and well slaked lime, it is necessary to add some "spreader" or "wetting compound" in order to obtain the greatest fungicidal efficiency. Several brands of these products may be obtained locally, but it is advisable to purchase the more up-to-date substitutes for the old-fashioned casein.

Proprietary Copper Sprays.—There are at least four brands of proprietary copper sprays on the local market. These are as follows:—"Capex" Dry Bordeaux and "Lunevale" Dry Bordeaux, two ready-mixed powders, both of which require the addition of "wetting compound." The former

brand may be added in bulk to a measured quantity of water and stirred into a suspension ready for use, but the latter requires to be sifted slowly into water, stirring all the while, in order to prevent the formation of a hard mass at the bottom of the container. 8 lbs. of "Capex" Dry Bordeaux added to 50 gallons of water makes a solution of 4-4-50 strength, while the same quantity of "Lunevale" powder should be added to 90 gallons of water to produce a spray of similar strength.

"Ky-Bordeaux," also a "Capex" product, provides crushed bluestone and slaked lime in separate packets and gives a spray fluid similar to home-made Bordeaux. It does not require the addition of a "spreader," which is incorporated in the contents. It is more expensive than "Dry Bordeaux" or home-made Bordeaux.

The fourth product, known as "Buisol," is a liquid which may be added to water in bulk and is then ready for use. It does not require "spreader." I have seen no reference to its use on tobacco elsewhere, but it proved to be satisfactory in our tests. It was used at the rate of 3½ lbs. per 100 gallons. After this spray has dried on the leaves, it cannot be detected by casual examination and plants appear to be unsprayed. Its relative cost I am unable to state, as its local retail price has not yet been announced.

It should be remembered that all these products sell at very much reduced prices for large quantities. Farmers should, therefore, purchase their full requirements in one order and see that they are supplied with material in bulk. The cost of fungicides in small packets is two or three times that of the same material in large containers.

Now for a final admonition regarding seed-beds. Having obtained suitable equipment and spray material, do not spoil the whole concern by slipshod spraying. A suitable nozzle will produce a very fine mist which needs to be applied gently to the plants so that it will cover the whole leaf surface. Hold the nozzle well above the bed and do not soak the plants so that the liquid runs from the leaves. If the spray fluid is correctly prepared and contains an efficient wetting compound, an even film of liquid will, by this means, spread over the exposed surfaces of the seedlings and give complete protection from disease germs. But as the plants grow, areas of new and

unprotected leaf rapidly develop, so that spraying *must* be carried out at regular intervals. Generally speaking, once a week is a good time-table to follow, but if a heavy shower of rain should wash the spray from the plants, then another application should be made immediately. The spraying should be done last thing in the afternoon and the plants should not be again watered until the next day in order to allow the Bordeaux to dry on the leaves. Once dry, the deposit is difficult to remove.

It is a common habit to discontinue spraying when the plants are being "hardened off," but such procedure is pure folly. The protective covering should be maintained until the seedlings are transplanted and, as I shall indicate later, further application be given in the lands.

FIELD SPRAYING.

For a number of years spraying tobacco in the field has been practiced on an experimental scale by this Department. In a number of instances I have been forced to adopt this measure in order to control angular spot and wildfire in experimental plots where their presence was undesirable. The method adopted was to prime off the heavily infected bottom leaves and apply Bordeaux Mixture, either with a bucket pump or a hand pump. In all cases of early infection I have obtained excellent control of bacterial diseases by this means, and have been struck by the facility with which the "boys" execute the work and the cheapness of the operation. To extend this experimental spraying to a field scale was but a short step, and I have received good reports from a small number of farmers who have adopted field spraying during the past four years. The equipment employed consists in general of a 5-gallon drum of Bordeaux Mixture solution, slung on a pole carried by two "boys," which feeds a hand pump, carried by a third "boy" in front, through 10 to 12 feet of ⅜ inch rubber hose. A fourth "boy" completes the gang, so that the spraying may be continued without numerous rest periods. When an emergency occurs, the "boys" can be worked in shifts, allowing as much as 20 acres a day to be covered by one pump. The cost of the operation varies with the brand of Bordeaux Mixture used. In experiments carried out last season on the Salisbury Tobacco Research Station it was found that 20

gallons of fluid were sufficient to spray one acre of tobacco three weeks after transplanting. Using home-made Bordeaux with bluestone at 6d. per lb., the cost of material alone amounts to 10d. per acre at Salisbury. It has been found that, full labour charges included (although extra labour is not engaged for the work), the total cost of the operation varies, according to district and brand of fungicide, from 1s. 3d. to 1s. 10d. per acre.

Last season one grower, Major Hastings, decided to make up wheeled equipment which could spray 6 rows at a time in order to cover a large acreage in as short a time as possible. I was fortunate enough to be able to see this spray cart in operation and am satisfied that the general principles are quite satisfactory for tobacco. Unfortunately, the type of pump required to give a really efficient spray does not appear to be stocked in South Africa, but one firm in Salisbury has sent specifications to a manufacturing firm in Britain, asking for quotations. I have delayed writing in the hope that more details could be given about wheeled equipment, but no answer has as yet been received from overseas, and I feel it imperative that this article should appear before the tobacco season begins.

As the capital expenditure on the cart alone for this type of spray outfit is rather high (unless the grower is possessed of a Scotch cart), I have also been investigating the possibilities of dry spraying, or dusting, by means of small portable rotary blowers. The great improvement which has been made in fungicidal dusts during the past few years warrants the hope that this convenient method of spraying may come into general practice.

In 1927 and 1928 dusting experiments were carried out by this branch against angular spot and frog eye, but the results obtained were not satisfactory and did not compare at all favourably with those obtained by using wet sprays. Since that time, however, new products have appeared upon the market, and it is hoped that they will prove to be more efficient in the experiments planned for this coming season. The chief drawback to dry sprays in the past has been their poor sticking powers; a heavy shower of rain being usually sufficient to remove most of the fungicide from tobacco leaves.

CONCLUSIONS.

To sum up, it may be stated that the enormous loss from disease which is experienced every season warrants the adoption of more precise methods of control, so that spraying plants in the field appears to be a necessary condition for the attainment of this object.

Numerous details regarding the number of sprayings required, the best times to spray—*i.e.*, before or after priming, the kind of fungicide to be used, the most efficient and economical type of spray outfit to employ, etc., require to be investigated more fully, but the methods now being used by several growers have given good results and have been found to be suited to farm practice.

SUMMARY.

1. Further practical notes on seed-bed spraying are published for the use of tobacco growers.
2. Details are given of successful control of Angular Spot, Wildfire and Frog Eye at the Tobacco Research Station by using these methods.
3. The correct kind of spray equipment is described, and common mistakes made in the actual spraying operation are indicated.
4. Notes are given on the cheapest methods of purchasing fungicides and what essential ingredients should be used in their preparation.
5. Available information on field spraying of tobacco is given for the first time, and the operation recommended.

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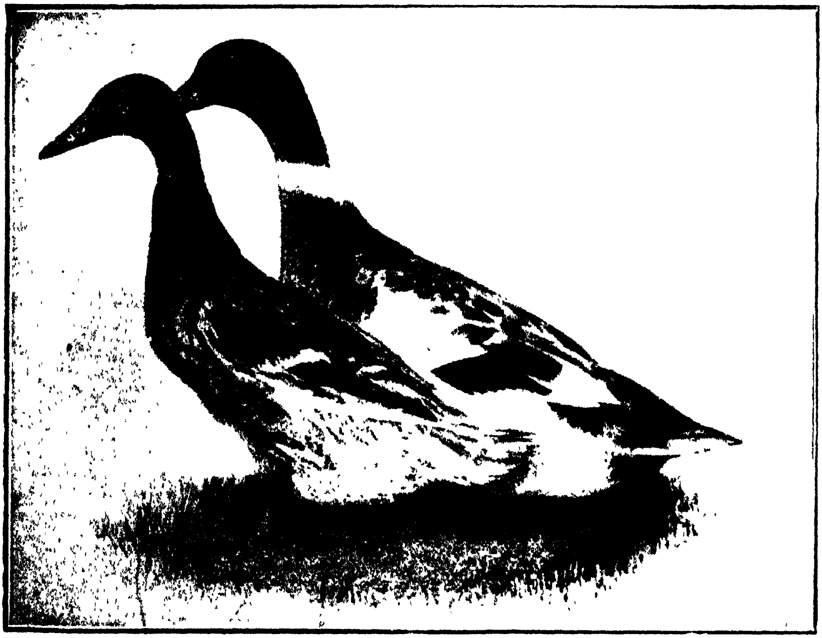
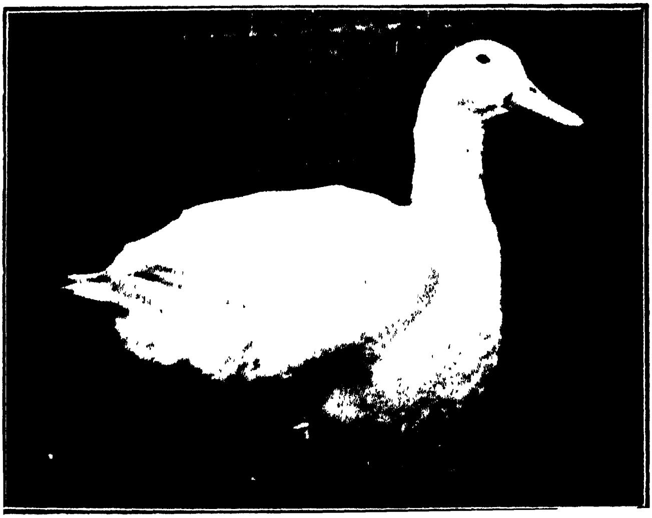
Pekin ducks Indian Runner ducks



Campbell duck and drake.



Aylesbury duck

Rouen drake and duck.
(From Wright's book on poultry.

Ducks on the Farm.

(REVISED.)

By H. G. WHEELDON, Poultry Officer.

Of the many profitable undertakings in connection with the poultry industry, the one which can be regarded as the most profitable next to the "raising of pullets for egg production," is the production of ducklings for table purposes.

Although the raising of ducks in Rhodesia has received some attention and is a profitable source of income to many breeders, it is still a somewhat neglected branch of the industry. It is certainly capable of greater development and is a remunerative business when carried out under modern methods of hatching and rearing, and provided the work is undertaken in close proximity to the market and conducted economically.

Ducks are one of the quickest maturing birds we have. They are easy to rear, and for young fat ducks about ten or twelve weeks old there is a good demand. At this age the flesh is tender and juicy and realises a comparatively high price. Up to this period also the flesh is more economically produced, and all ducks intended for table purposes should be sold at this age. Ducks are considered to be the hardiest of the inmates of the poultry yard, since the loss of ducklings should not be more than from 2 to 5 per cent. They are less subject to disease or insect vermin, they are easy to control in runs, and the equipment required is neither extensive nor expensive.

The farmer can feed ducks at a minimum cost, as one-third of the bulk of food for stock ducks may largely consist of vegetables leaves or other suitable green vegetation. If the farmer is a dairyman, the skim-milk fed to stock ducks furnishes the best of nourishment at little cost, and if fed to growing ducklings will produce twice or three times the value it would if fed to many other classes of farm stock, although there is a demand for well fattened ducks. Duck eggs are not

in as great demand, except for cooking purposes, as they should be, considering that their food value is as great as hens' eggs. They are a trifle richer and perhaps slightly less digestible, but they should be in greater demand than they are found to be.

Breeds.—There are quite a number of wild and domesticated varieties of ducks. The best known breeds of the latter are the Aylesbury, Pekin, Rouen, Indian Runner and Muscovy. The less known varieties which are gaining popularity are the Khaki-Campbell and Buff Orpington. Other breeds are the Cayuga and the Crested Duck.

The Aylesbury.—Is a fine white bird with a long, broad, deep body carried horizontally—the keel practically parallel with the ground—with light coloured bill and bright orange shanks and feet. The flesh is solid and white. The Aylesbury is essentially a table duck and matures very quickly, the ducklings if properly fed and cared for will weigh 5 lbs. to 6 lbs. in ten weeks. This breed is the favourite in England. Standard weights: Drake, 10 lbs.; Duck, 9 lbs.

The Pekin.—This is the favourite breed in America for both utility and exhibition purposes. It is not quite so long in body as the Aylesbury and the carriage is more upright. It is white in plumage, tinged yellow or cream. The flesh is yellowish with a delicate flavour. The bill, shanks and feet are bright orange in colour. Eyes dark lead-blue. Standard weights: Drake, 9 lbs.; Duck, 8 lbs. The Pekin is considered to be the best general purpose breed of duck. It matures fairly quickly, but is more active and a better layer than the Aylesbury, and is a non sitter as a rule.

The Rouen.—Is essentially an exhibition breed, and is the most beautiful breed of all domesticated ducks. The type, size and carriage are not unlike those of the Aylesbury. They are generally slightly heavier and more ungainly in movement than the two previous breeds, and the skin is slightly dark in colour. In quality and colour of plumage it resembles the wild duck or mallard, except that this has been bred darker and richer. The eggs are somewhat small as a rule, and some strains are fair layers. Standard weights: Drake, 10 lbs.; Duck, 9 lbs.

The Indian Runner.—Is essentially kept for egg production, being a remarkably prolific layer of large, light coloured eggs of good shape. The two best known varieties are the white and the fawn and white. The body is long, narrow and racy-looking, the carriage being very erect, somewhat after the form of a penguin. Indian Runners are hardy and the best foragers. They do well without swimming water and are easy to rear. The standard weight of Drake is $5\frac{1}{2}$ lbs. and the Duck 4 lbs. The weight of either sex should not exceed $5\frac{1}{2}$ lbs. nor be less than $3\frac{1}{2}$ lbs.

The Muscovy.—There are many of these in South Africa. They differ greatly from ordinary domesticated ducks in type and about the head. The colours vary from white with a black crest to black and black and white. The face is free from feathers and fleshy and bright red. The drake weighs about 10 lbs. and the flesh is medium dark in colour, but varies with the food they eat. They do not make good table ducks, except when young, and from a grower's point of view they are rather slow maturing. The size of the drake as compared with the duck varies greatly at the same age, which is a disadvantage for marketing. They are good sitters and fairly prolific. One point about this variety is their eggs take five weeks to hatch as compared with four weeks in other varieties. Muscovies are also more difficult to control in runs, as they are good fliers.

The Campbell Duck.—Is somewhat like the Rouen in appearance but much lighter, with a plain head of a greyish-brown shade; the drakes have grey backs and a pale claret breast, and the legs are yellow. The original strain was descended from one duck which exhibited most remarkable laying powers, the object being to produce excellence in laying, with fair table qualities and quick maturity. They are not very large, stock birds weighing $4\frac{1}{2}$ lbs. to 5 lbs., and in flavour they are said to considerably resemble the wild mallard, which was used in crossing as one of the foundations of the strain. The Khaki-Campbell is a sub-variety of this, and of more recent production. The Indian Runner has been used in crossing to produce this variety, and as a result the Khaki-Campbell duck is of extremely active habits, doing best on free range and showing very little desire for swimming. At whatever time of the year they are hatched, they are said

to commence laying at six months old, and even sooner, so that by hatching three lots very early medium and late eggs may be obtained all the year round.

Buff Orpington Ducks.—Were first brought into prominence in England in 1908, when they were shown at several large shows. In Australia they had previously made their reputation by winning two twelve months' laying competitions in succession. They are intended to fill the demand for a first-class layer, combined with good table qualities. They originated by mating Indian Runner to Aylesburys, Indian Runners to Rouens and Indian Runners to Cayugas The above varieties were carefully bred and selected for three years for egg production alone, before the above crossing was done. The offspring of these matings were then crossed back and forth until with time, care and patience, the desired object was accomplished. Many of the birds in the progeny showed a lot of blue in the plumage, and these were also carefully selected and mated with pure-bred Cayugas and Pekins, then the same process went on with these, mating and intermating until the Blue Orpington was standardised as in the case of the Buff variety.

In South Africa there are many crosses of the Aylesbury and Pekin, and both being, as they are to the casual observer, white, they are therefore much alike. Their distinguishing characteristics are, however, well marked, as will be seen from the following:—

	The Aylesbury.	*The Pekin.*
Body	Deep and long.	Short and deep.
Colour of plumage	Pure white down to the skin.	White, with canary-yellow tinge, especially under the wings.
Head	Rather flat and longer than that of the Pekin.	Deep, rounded and short from front to back, and prominent forehead.
Beak	Pinkish or flesh colour.	Orange or yellow.
Eyes	Dark.	Dark lead-blue.
Carriage	Horizontal.	Upright.

It will thus be seen that there are distinct differences in the two breeds, and duck raisers should note this when buying or selling pure bred stock.

Housing.—The housing of ducks is not a difficult matter and does not require much detail. An open wire fronted low-built shed on sloping ground will prove satisfactory; 6 ft. high in front and 5 ft. at the back, 12 ft long and 10 ft. deep will accommodate 50 adult ducks. As ducks are very susceptible to rheumatism and cramp, it is most essential that the roof of the house be water-tight or free from leakages. The floor inside should be elevated above the surrounding ground and this should be hard, preferably made of cement, sloping gradually from back to front of the house, well littered and kept dry and clean by frequently renewing the litter. Wooden and earth floors are the least desirable, as they quickly become tainted and are difficult to keep dry and clean. The sides of the house need not necessarily extend to the roof; it is desirable to leave an opening three or four inches above the walls and below the roof for ventilation, as ducks like plenty of ventilation. Nest boxes are not required, a duck prefers to make its own nest on the floor. A few bricks may be provided and conveniently placed inside on the floor for the purpose. A wire netting enclosure 3 ft. high should be provided. It is advisable to keep the breeding and laying ducks away from swimming water until 10 a.m. or 11 a.m. during the laying season, supplying them with drinking water only for this period, otherwise they are very liable to lay their eggs in the water, which generally means a loss. An enclosure 3 ft. high is ample to confine them. Where possible, a water furrow through the yard would be of great convenience and save a lot of trouble as far as the water supply is concerned.

Selecting and Care of Breeders.—Vigour, quality and early maturity are the primary consideration in selecting breeding stock. Large birds are desirable with good shape and a deep body. Medium size active birds are more satisfactory than larger ones, which may be coarse and consequently take longer to put on flesh and fatten. The ducks which are to be kept as future breeders should be selected when six weeks old. At this age a careful selection should be made by picking out the more advanced and promising ducklings, and these should

be ringed and allowed free range with plenty of exercise to build up birds with vigour and well-developed frames. Early hatched, fully developed young birds generally make the best breeders; preferably a vigorous drake twelve months old mated to two-year-old ducks or two-year-old drakes with yearling ducks.

The question of how many ducks to mate safely to a drake is governed to some extent by the water supply. Breeding ducks must have water to swim in, but not necessarily deep water, in order to make sure of getting fertile eggs, although "dry" rearing has produced strains that breed satisfactorily without water for swimming. It is better, however, to supply the heavy breeds of ducks with swimming water as a protection for their feet. If a running stream or water furrow through the yard is not available, a small pond 6 ft. square and 1 ft. deep with sloping sides in each pen will suffice for a breeding pen of six birds. The sides and bottom of the pond should be lined with cement and the water renewed at least once a week, according to the season of the year. A breeding pen may consist of three, four or five ducks and one drake, and the stock should be mated a fortnight before the eggs are needed for hatching purposes. In the event of there being an ample water supply and unlimited space, the breeding stock may be mated in the proportion of three drakes to twelve ducks at the commencement of the season, and as the weather becomes warmer the number of ducks may be increased to 18 or 20 with advantage. This system of mating applies more particularly to the duck farmer who raises ducklings for market. It is important that the male and females should not be too closely related if hardy, vigorous ducklings are required. Ducks may be bred from until they are three or four years old, and the drakes to be mated to ducks of this age should be preferably two years old.

The breeding stock should be mated about May. Before setting large numbers of eggs or sending out to customers, it is advisable to ascertain the fertility of the eggs. As a rule the first eggs laid by young birds are apt to be infertile, though if the birds are well cared for and properly fed, the fertility quickly improves. It is customary, therefore, to test the fertility in an incubator or under broody hens until good

results can be relied upon. Young ducks generally lay eggs in the early part of the season, and the older birds come on as the spring advances and as the weather becomes warmer.

Feeding.—The first essential to successful duck-raising is to provide food for the ducks at a reasonable cost at all times. Unless the animal and other concentrated foodstuffs can be obtained at a reasonable cost duck raising for market is likely to prove unprofitable. It is not so much the actual cost of food consumed by the growing ducklings themselves if disposed of early, as the cost of maintaining under some conditions a large number of breeding stock during the off season, and it is on this account that the profitable raising of ducks depends upon efficient management and economical costs of production.

With reasonable care the feeding of stock ducks is not a difficult problem, provided the ducks are allowed exercise, either foraging about or swimming, which prevents them from becoming too fat. Ducks are somewhat large eaters and readily put on fat, so that with swimming exercise and judicious feeding the risk of an over-fatty condition of the birds may be reduced to a minimum. With good range, stock ducks do not require much food, as they would pick up a great deal in streams of water in the form of worms, grubs and weeds; in such circumstances a little mash in the morning and grain in the evening will suffice. It should be pointed out that ducks are gross feeders of vegetable and animal foods, even more so than fowls, and for best results these must at all times be supplied to them when kept in confinement or where they do not have access to streams of water. A deficiency of either of the above will retard the production of eggs. Another important item in the feeding of ducks is a liberal supply of oyster shell or lime during the laying season. In this respect ducks might be termed artificial birds, for if oyster shell is withheld egg production may cease entirely, and young ducks six months old will very often delay in commencing to lay if not supplied with oyster shell or well slaked lime. Ducks must also be supplied with grit. If at any time it is necessary to change the diet, this should be done

gradually, as any sudden change of food may affect the fertility of the eggs, or will interfere with the production. The mash should consist of:—

Bran	20 lbs.
Pollard	30 lbs.
Mealie Meal	25 lbs.
Lucerne Leaf Meal	10 lbs.
Animal Food	15 lbs.

Moist mash should be given to ducks in shallow trays or troughs morning and evening.

A suitable ration can be made up by boiling meat scrap or offal, when obtainable and dried off or mixing pollard, bran and cut up vegetables leaves to a compact but not a liquid consistency.

The best grain foods for stock ducks are wheat and oats; crushed mealies will prove satisfactory, if not supplied too liberally. The grain food should be fed in water in a pond or large shallow vessel containing water. This method of feeding the grain is the most natural and the ducks are better able to pick up the food and enjoy it. Oyster shell and grit should be available and given in the same way, which if thrown into a pond will keep the ducks occupied in searching for it and will encourage them to exercise.

Incubation.—If duck eggs are slightly more difficult to incubate than hen eggs, the duck raiser has one consolation, in that ducklings are more easy to rear than chickens. Duck eggs intended for hatching should be carefully stored to prevent evaporation, and the fresher they are when set the better. They may be set either under ducks, hens or in an incubator. Ducks, however, usually make indifferent sitters and worse mothers, and they are more difficult to control and handle than hens.

The condition for the successful hatching of duck eggs are similar to those employed with hen eggs, except that duck eggs require a lower temperature, namely, 102 to 102½ degrees F. at the commencement, and after the second week a temperature of 103 to 103½ degrees F. would do no harm

to the embryo ducklings. It should also be remembered that duck eggs require more moisture than hen eggs do. The egg shell of the former being thinner and more porous, evaporation of the contents is greater and more rapid in dry weather. It is necessary to spray the floor of the incubator room with water during the dry weather in addition to the moisture supplied in the water tray of the machine. When broody hens are used for hatching purposes, moisture can be supplied by digging a hole two feet deep and two feet in diameter where the nest is to be placed. Pour in four or five gallons of water and replace the soil, and when the hole is filled up make a concave depression in the loose soil and line with clean straw or grass; the nest is then ready for the eggs. The eggs will not require additional moisture unless the weather is very dry and windy, when they may require sprinkling with tepid water during the last week of incubation. The incubation period of duck eggs is 28 days, during which time the eggs should be tested twice, namely, on the seventh day and again on the fourteenth day of incubation.

Ducklings when hatching generally chip the shell twelve to thirty-six hours before making their exit, during which time they are absorbing the remaining yolk for their support after hatching. When necessary to open the incubator drawer, the chipped part of the eggs should be turned upward. If this is done quickly, gently and without too long exposure, and if the ducklings are not hatching out easily, the fractures should be examined to see if the lining membrane of the eggs is too tough. If so, a little discreet assistance by opening the shell without causing bleeding may help matters. It is not advisable, however, for the incubator to be opened at hatching or any other time oftener than is absolutely necessary, that is to say, twice daily about twelve hours apart. Ducklings are longer in getting clear of the shell than chicks, therefore the operator should not be unduly anxious. It is important to maintain the temperature in the machine, as there is greater danger of chilling wet and half dry ducklings, such as by opening the drawer frequently and the temperature thereby reduced.

During the time of hatching there should be ample moisture in the egg chamber, so much that it will condense at the ventilator holes, or in some machines on the observation glass of the door. If the orifice made by the ducklings in the shell dries, the duckling may become attached to it and thus unable to make its exit. When the hatch is well advanced the ducklings should be taken from the drawer and placed in the drying box or in the nursery below the egg tray. This should be done in the morning, the dry ducklings only being removed to the drying box or nursery, where they should remain for twenty-four hours after the hatch is complete and then removed to the brooder.

Rearing and Feeding.—The future of young ducklings depends first on the stamina and condition of the breeding stock and next on how they may be treated during the first ten days of their existence. As a general rule ducklings require less warmth than chicks, but they must be kept dry. They can be raised very satisfactorily in cold brooders similar to those used for brooding chicks. Attention should be drawn to the fact that young ducklings are very susceptible to sunstroke and they should have access to plenty of shade. For young ducklings a small run covered on top to supply shade is desirable for this purpose. After a week old the ducklings need not be strictly confined to the hover during the night in warm weather, which will not only be a means of increasing ventilation, but during moonlight nights especially they prefer to make periodical visits to the food trough, in which dry mash should be placed. A shallow vessel containing water must also be accessible and placed a little distance away from the dry mash, when they will run to and fro and return to the hover again for warmth. This practice is a very desirable one and should be encouraged; as by this means the ducklings will make remarkably quick growth, which is essentially required for market ducks. They must have constant clean water, as they will probably insist on spilling and fouling it; this may be avoided to some extent by providing tins inverted in suitable vessels, which is the best means of supplying water. If these are placed on a board the litter is to some extent protected. The first feed should consist of fine grit, which should be given in the drying box of the machine; and when removed to the brooder a little grit may

also be placed in a shallow vessel containing drinking water. When the ducklings are 24 hours old they will be ready for their first feed of mash, which may consist of equal parts of bran, pollard and mealie meal, moistened with skimmed milk or warm water. If skimmed milk is unobtainable add 8 per cent. meat meal. The food must be crumbly and damp, not sticky or too wet.

Ducklings must be fed frequently and regularly during the first few days; make sure they begin to feed, for sometimes they are slow in doing so. Do not on any account allow the food to lie about and become stale and sour, as this will prove very harmful to the ducklings. After the first ten days 10 per cent. meat meal or cooked meat scraps or offal and plenty of finely-chopped tender green food may be added to the mash with advantage. A little grain may be given once a day in the drinking water with the grit when they are three weeks old. The ducklings which make good rapid and vigorous growth and show a symmetrical development should be selected for next season's breeding, and at six weeks old they should be separated from those that are intended for the market and continue to feed them as above. Place them in a large, well-shaded enclosure to develop naturally, and at eight weeks old allow them to have free range, or after the breeding season they may be turned out with the older ducks to forage about for most of their food. The ducklings that are intended for the market should not be allowed access to swimming water, and should at the age of six or seven weeks, when their frames are sufficiently grown, be confined in a small enclosure without overcrowding and fed with the object of fattening them. The following mixture moisted with water or milk has proved satisfactory.

2 parts Mealie Meal,
1 part Bran,
1 part Cut Green Food,
10 per cent. Meat Meal,

to which add a little powdered charcoal.

They must have a constant supply of drinking water and grit, and, of course, they must have shade. It is better to leave them a little hungry than to over-feed them. Fifteen

to twenty minutes is time enough for ducklings to eat all they should three times a day, and whatever is left should be removed. Ducklings fed in this way should weigh 5 lbs. to 6 lbs. at ten weeks old.

Do not keep them longer than ten to twelve weeks of age. This should be the limit, as they then grow their adult plumage and pin feathers and which, during the next six weeks, will require a lot of nourishment for their growth, the result being that the ducklings do not gain in weight. The food they consume during this period would add so much to their cost that instead of showing a profit they would show a loss.

An effort should be made to commence hatching as early as possible in the breeding season, and produce consecutive batches of ducklings for market throughout the season. Market birds of the same age and as near as possible uniform in size and value at a time.

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 21. August, 1934.

The only species of locust recorded in the Colony during August has been the Red Locust (*Nomadacris septemfasciata*, Serv.).

As anticipated, swarms have become much more active with the advent of warmer weather, and the Colony has also sustained invasion of very large swarms *via* Northern Rhodesia. These have been variously described as 25 and 30 miles long, whilst one was stated to have taken two days to pass over one farm. This series of large swarms has held a S.E. direction through the Lomagundi district.

Swarms have been reported mainly from the north-eastern and eastern districts of the Colony, although a few have been recorded in Wankie and other western districts. No locusts have been reported in the southern districts or the Midlands.

As last year, the humid Eastern border seems to have been specially attractive and the swarms have remained there with only minor movements.

Enemies and Disease. All specimens examined have been healthy. *Empusa* has not been in evidence during the month.

Damage.—Some damage to irrigated crops has occurred, but such damage has not been general. Early veld has been eaten off, especially on the Eastern Border. Considerable damage to Eucalyptus and other plantations has occurred, chiefly due to the weight of the locusts breaking branches, and in some cases the actual trunks of big trees have snapped.

Outlook.—Whilst the outlook for the coming hopper season would appear to depend rather upon the number of locusts to the north of the Colony than upon the present infestation of the Colony itself, the prevalence of many large

swarms cannot be disregarded as indicating the possibility of a severe outbreak of hoppers during the coming wet season.

The outlook for the Union of South Africa in respect of pre-breeding invasion from the north would appear to be serious.

RUPERT W. JACK,
Chief Entomologist.

SALES.

Agricultural Experiment Station, Salisbury

Spineless Catcus Slabs (blades) Algerian variety, per 100 Slabs 7/6 delivered at the Salisbury Experiment Station, or 10/- delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Kudzu Vine Crowns, per 100 Crown 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns during November and December.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbury.

Southern Rhodesia Veterinary Report.

JULY, 1934.

AFRICAN COAST FEVER.

The disease was diagnosed on the farm Greyling, Charter district, north-west of the Wiltshire Estate, where several herds dip at one tank; mortality 41.

The infected herd on Wiltshire Estate, Charter district, was moved to a clean paddock after a total mortality of 24. It was discovered that 44 oxen were moved from the farm Greyling to a paddock in the north of the estate and several had temperatures; these oxen were all destroyed and the disease diagnosed microscopically in 17 head. This paddock remains free of cattle.

FOOT AND MOUTH DISEASE.

The existence of this disease was discovered at Nuanetsi Ranch, in the Chibi district, and on Crown land south of Gwanda, in the Gwanda district. Police cordons have been placed round the areas; the cattle within are being inoculated and cattle surrounding being driven outward to make a cattle-free belt.

TRYPANOSOMIASIS.

Three cases in Melsetter district and one in the Lomagundi district.

TUBERCULIN TEST.

Seventy-five head of cattle were tested on importation; no reaction.

MALLEIN TEST.

Thirty horses were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protetorate: Bulls 18, cows and calves 22, heifers 38, horses 30, sheep 295.

EXPORTATIONS.

Bulls 4, sheep 83.

To Johannesburg for local consumption: 447.

To the United Kingdom, *via* Union Ports in cold storage: Beef quarters, 5,438; beef boned quarters, 1,906; veal boned quarters, 106; tongues, 5,360 lbs.; livers, 8,504 lbs; hearts, 7,505 lbs.; tails, 4,588 lbs.; skirts, 2,832 lbs.; shanks, 7,364 lbs.; kidneys, 187 lbs.

Meat products from Liebig's Factory:—Meat meal, 83,600 lbs.; bone meal, 84,000 lbs.; Neats foot oil, 4,696 lbs.; tallow, 19,414 lbs.; beef powder, 28,817 lbs.; meat extract, 23,142 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

AUGUST, 1934.

Barometric Pressure was generally about normal for the month.

Temperature.—Although very little hot weather occurred until the last day or two of the month, mean temperatures were everywhere above normal. High minimum temperatures were in the main responsible for this, but in parts the mean maximum was also above normal.

Rainfall.—A few showers were reported from different parts during the month, but no heavy falls occurred.

AUGUST 1934.

Station.	Pressure Millibars, 8.30 a.m		Temperature in Stevenson Screen °F.								Rel Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min	Max	Min	½ Max Min	Normal.	Dry Bulb	Wet Bulb.	%	F.	0-10	Ins.	Normal	No of Days	
Angus Ranch... ...	...	...	90	49	81.1	55.8	68.4	64.2	63.6	57.0	67	52	...	...	.02	...	..
Beit Bridge	970.0	...	94	41	82.8	51.9	67.3	...	65.8	56.9	57	50	1.5	...	.09	...	1,500
Bindura...	896.3	.	84	42	77.3	51.5	64.4	.	62.1	53.2	55	46	2.0	...	.03	...	3,700
Bulawayo	872.7	872.8	84	43	75.7	50.2	63.0	60.8	62.1	51.5	49	43	2.5	..	.03	...	4,426
Chipinga	897.3	...	83	49	73.2	52.5	62.9	...	63.4	56.3	66	52	3.0	18	54	3	3,685
Enkeldoorn	861.6	...	81	42	73.6	47.7	60.7	59.9	61.1	53.3	61	47	1.5	...	.04	...	4,788
Fort Victoria	900.1	900.4	86	41	77.1	48.6	62.8	58.6	62.6	53.6	56	46	1.9	06	.07	1	3,571
Gwaai Siding	910.7	...	90	37	83.1	46.0	64.5	...	61.2	51.8	52	44	0.7	.01	...	1	3,278
Gwanda	901.9	...	88	44	78.9	52.4	65.7	...	63.5	53.7	53	46	1.9	...	.07	...	3,229
Gwelo	866.5	...	84	42	75.2	48.8	62.0	59.6	60.7	52.4	58	45	2.1	.01	.08	1	4,628
Hartley	890.8	...	86	41	79.0	47.6	63.3	62.3	61.0	52.3	55	45	1.3	...	.02	...	3,879
Inyanga	840.4	...	75	39	68.5	46.6	57.6	...	59.6	50.6	52	42	2.9	.30	.07	3	5,514
Marandellas	841.3	...	76	42	70.0	47.8	58.9	...	59.0	51.2	59	45	1.9	.04	.08	1	5,452
Miami	882.8	...	84	44	76.5	49.9	63.2	..	64.0	54.4	53	47	1.0	...	.04	...	4,078
Mount Darwin ...	912.0	...	88	41	79.4	51.4	65.4	..	65.8	58.4	64	54	2.5	...	.01	...	3,180
Mount Nuza	805.3	...	66	41	58.8	45.0	51.9	...	50.5	46.7	78	44	5.2	31	...	5	6,668
Mtoko	881.8	...	85	46	75.5	53.2	64.4	...	...	...	...	...	2.2	...	.05	...	4,140
New Year's Gift...	...	...	90	49	79.3	53.2	66.2	...	62.2	56.0	68	51	...	07	.13	2	2,690
Nuanetsi	967.8	...	93	41	83.4	49.3	66.4	...	67.3	58.4	59	53	2.6	. .	.06	...	1,580
Plumtree	868.1	...	85	43	76.2	52.3	64.3	..	63.0	51.3	44	41	0.7	.	.06	..	4,549
Que Que	886.5	...	86	44	78.0	49.9	63.9	...	63.9	55.3	58	49	1.3	...	.01	...	3,999
Rusape...	866.5	...	80	40	71.9	45.4	58.6	...	58.9	51.9	62	46	2.4	.41	.05	2	4,647
Salisbury	858.7	858.6	79	40	74.2	48.4	61.3	59.6	61.7	52.7	54	45	1.8	.01	.12	1	4,885
Shabani	912.3	...	88	48	78.5	55.0	66.8	..	63.2	53.9	55	47	2.0	.01	...	1	3,193
Sinoia	892.6	...	85	38	79.1	45.0	62.1	...	64.4	54.8	53	47	0.6	...	.04	...	3,794
Sipililo	889.2	...	84	45	76.2	53.7	65.0	..	64.6	54.2	51	45	1.3	.36	.04	1	3,876
Umtali...	897.7	897.6	86	45	75.3	52.0	63.6	61.4	62.4	57.0	72	54	3.8	.21	.19	3	3,672
Wankie	931.2	...	94	52	85.7	60.3	73.0	...	68.3	54.2	38	41	0.3	...	.01	...	2,567

Farming Calendar.

OCTOBER.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stocks require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough in December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time

of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," September, 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm (*Heliothis obsoleta*).

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation.

Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds, especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease," is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and carmp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate, it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleansed out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

NOVEMBER.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally. where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required. artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour. use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenic of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying lands. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to be excellently in this Colony:—Balsam, Calliopsis, Centaurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox. Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkins, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult. come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value If normal rains have fallen, the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boilnig water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

TOBACCO.

Continue to sow seed beds, watering. etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery. gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

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REPORTS ON CROP EXPERIMENTS.

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TOBACCO.

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LIVE STOCK.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

New Cattle Policy for the Colony.—As intimated recently in the daily press Cabinet has under consideration a new cattle policy for the Colony, the details of which it is hoped to publish in the near future. The main objects of the new policy are to establish the chilled meat market in Great Britain on the basis of quality, not quantity, in the first place, and to give our cattle farmers an assurance that this object will be maintained for a period of years so as to secure the necessary continuity of supplies of suitable animals for the purpose. It is interesting to note that since shipments of chilled beef have been restarted after the break caused by foot and mouth disease the grading has been tightened up still further and that the result has been an increased interest in

Rhodesian beef, and improved prices. From the beginning of next year all beef imported into Great Britain must be stamped either with the name of the country of origin or with the mark Empire Beef. If we are satisfied that adequate supplies of really good quality beef will be maintained it is considered desirable to endeavour to establish a market for Rhodesian beef and to mark it as such; but it is realised that many farmers will be disinclined to apply themselves seriously to the production of suitable cattle unless some assurance can be given that the outlet will be maintained and that definite prices can be fixed. To meet this position is, therefore, the main purpose of the new policy, and all farmers who are interested in this branch of farming can be assured that the Department will be glad to assist them with advice on all the essential points, including the type of animals to feed, the growing of suitable crops and the mixing of suitable rations.

Visit of Mr. R. A. Tarrant.—Mr. R. A. Tarrant, an officer of the Queensland Department of Agriculture and Stock, is visiting Southern Rhodesia to obtain first-hand information regarding our methods of growing and handling flue-cured tobacco. This Colony was chosen for this purpose because the climatic and soil conditions are very similar in many respects to those of Queensland. He proposes to spend the whole of the coming tobacco season here and will endeavour to visit Nyasaland and Northern Rhodesia. On his way through from Durban he spent some time in the Rustenberg area and was given every facility to visit various experimental stations by the Union Department of Agriculture. We trust that Mr. Tarrant's visit will be an instructive and a pleasant one.

Soil Conservation Advisory Councils.—The Minister of Agriculture and Lands has approved of the appointment of two Soil Conservation Advisory Councils, one for Mashonaland and one for Matabeleland. The functions of these Councils will be:—

(1) To recommend to the Honourable the Minister means whereby the objects of the Rhodesia Agricultural

Union's Soil Erosion Committee's report can be achieved as opportunity offers from time to time and to prepare draft legislation for consideration.

(2) To carry out propaganda work for the advancement of a national policy of soil conservation.

(3) To collect information and data relating to soil conservation.

The Mashonaland Council will comprise Messrs. E. W. L. Noaks, A. W. Laurie, the Hon. J. S. Parker (representatives of the Rhodesia Agricultural Union), Mr. H. S. Binks (Railway Engineer), the Manager of the Land and Agricultural Bank of Southern Rhodesia, the Assistant Chief Native Commissioner, the Government Mining Engineer, the Chief Forest Officer, the Chief Irrigation Engineer, and the Secretary, Department of Agriculture and Lands as Convener and Chairman.

The Matabeleland Council will comprise Major R. R. Sharp and R. A. Myburgh (representing the Matabeleland Agricultural Union), Mr. A. D. Cowper, A.M.Inst.C.E., (representing the Railways), the Government Mining Engineer, the Divisional Road Engineer, with the Irrigation Engineer, Matabeleland, as Convener and Chairman.

Weather Forecasts.—It is proposed to issue forecasts during the coming season on Mondays, Wednesdays and Fridays at about 12 noon. The forecasts will state in general terms the weather anticipated on the day of issue and the two succeeding days. Forecasts will be telegraphed to selected Departmental Post Offices where they will be posted for the information of the public. Telephone subscribers may obtain the forecasts from the nearest Departmental Post Office on payment of the usual telephone charges.

It is believed that little or no use is made of the forecasts sent to a number of Departmental Post Offices, and users of the service are required to notify the Meteorologist, Department of Agriculture, of their desire to receive the forecasts, giving the name of the Post Office and the method usually adopted to secure the forecasts. The assistance of all farmers

who are interested in this matter is urgently asked for, as it has been decided to discontinue telegraphing forecasts to all offices in respect of which no requests are received from the end of the present year.

Empire Tobacco.—The Council of the Tobacco Federation of the British Empire held a special meeting in London on July 16th in order to discuss matters with Mr. Huggins and Mr. G. N. Fleming. Representatives from South Africa, East Africa, Nyasaland, Jamaica, New South Wales and India were also present. Mr. Huggins emphasised the necessity for the co-operative marketing of all Empire tobacco and Mr. Fleming called attention to the low prices now paid compared with a few years ago and also pleaded for greater co-operation. Mr. B. F. Wright, of the High Commissioner's office, pointed out that at present only 22 per cent. of the tobacco used in the United Kingdom is of Empire origin, and that during the first five months of this year the amount of Empire tobacco used was almost 1 per cent. less than the average for last year. Representatives of Empire producing countries were asked to report on the present conditions and that to the present only two, *i.e.*, Canada and India, have done so. Mr. J. H. English, Trade Commissioner for Canada in London, pointed out that world over-production followed by low prices created a serious situation, and a reduction in the area planted was made in Canada during 1933. Bright flue-cured tobacco was reduced from 27,615,230 to 22,762,700 lbs. and Burley from about 16,000,000 to 9,000,000 lbs. It was pointed out that the increase in the Canadian crop was due to an extension of the growing area in new and better districts and improved methods. Owing to the low prices the Canadian Parliament appointed a Commission to enquire into the whole tobacco industry. The most important result is a tentative agreement between the growers and the manufacturers for improved marketing conditions. The manufacturers have agreed for three years from September 1st, 1934, to purchase an amount equal to that from the 1933 crop at a net average price of not less than 27 cents (1s. 1½d. per lb.) for the whole of the flue-cured production of Ontario. The growers have undertaken to reduce the acreage for the present season by 15 per cent., further export is to be arranged

through a co-operative organisation so as to obviate as far as possible tobacco being offered promiscuously by individual growers at cut-throat prices, and thereby to stabilise on some form of recognised basis the marketing of each year's crop.

With reference to Indian tobacco, it is stated that during the 1932-33 season no less than 1,111,000 acres were planted to tobacco in British India. The bulk of the tobacco grown is used locally, but during the last three seasons an average of 25,000,000 lbs. has been exported, of which about half goes to the United Kingdom and the remainder to Holland, Aden, Malay States and Japan. Of the Empire tobacco going to England India takes second place, *i.e.*, Nyasaland 29 per cent., India 25 per cent., Southern Rhodesia 20 per cent., Canada 18 per cent. Practically the whole of the Indian tobacco has up to the present been used for pipe mixtures, but during the last few years plant breeding has been carried on in an attempt to produce cigarette types.

Making Compost by the Indore Process.—The Institute of Plant Industry at Indore, India, has developed a method of producing a compost from waste products which is stated to be two to three times as valuable as a fertiliser as farmyard manure. This is described in detail by Howard and Wad in "The Waste Products of Agriculture," published by the Oxford University Press in 1931. It was really developed to assist the workers on small holdings. In the introduction it was pointed out that in the Eastern countries land has been cultivated intensively for many hundreds of years without the use of artificial fertilisers, but in order to increase production it is necessary to find some means of raising the standard of the holdings which will not involve extra labour or extra expense. The final compost is stated to be equal to or superior to Adco, although no chemicals are used in the process. The material used consists of all weeds, cotton and other stalks, green manure, fallen leaves, etc. All woody material such as cotton stalks are placed on the farm roads to be broken and crushed before putting them in the pits, and all green weeds and green manures are dried for a couple of days before putting them into the pits. The so-called compost factory is a very simple arrangement. It consists of a large number of

shallow pits with sloping sides and sufficient space between them for loaded carts to pass. The pits are more like depressions in the ground and are each 30 feet long by 14 feet broad and not more than 2 feet deep in the centre. It is stated that under Indian conditions the depth should never be more than 24 inches otherwise the compost does not decay satisfactorily owing to lack of air. Water is laid on to the pits at the Indore station, and it is stated that it requires from 200 to 300 gallons of water to make one cart load of finished compost. The process is continued throughout the year, but during the heavy rains the compost is made in heaps on the ground and not in the pits, as if too wet decomposition would be retarded. It is considered that the compost is not finished until about three months after being put into the pits, but the finished compost is so fine that 80 to 90 per cent. of it will pass through ¼ inch mesh. It is stated that dry straw or grass makes good compost. The material is spread in the pits in thin layers not more than two inches thick and each layer is then sprinkled with a very thin mud consisting of earth removed from the stable floors, wood ash and a small amount of manure, over this a small amount of compost two to four weeks old is sprinkled so as to supply the necessary moulds to set up fermentation. The covering of straw with a thin layer of mud is considered necessary. Layer after layer is added until the stack in the pit is some six or eight inches above ground level, and it is considered that each stack should be completed within six days. The stacks are watered once a week until finished and the whole stack is turned three times during the process so as to get uniform rotting. The amount of dung necessary to make satisfactory compost is indicated by the statement that 50 cartloads of compost can be made each year for each pair of oxen kept on the holding. The labour costs are stated to be 9½d. per cartload with wages on the station ranging from 15s. to £1 per month. Each time the heap is turned it is cut from the sides by means of a sharp spade or a heavy hoe in slices about 2 inches thick from top to bottom so that when finished it has the appearance of a dark brown finely divided leaf mould. In this finely divided condition it is stated that the improvement in soil condition and plant growth is much greater than that obtained by using twice the amount of stable manure or by a green manure crop.

The Weeds and Poisonous Plants
OF SOUTHERN RHODESIA.

By CHAS. K. BRAIN, M.A., D.Sc., Director of Agriculture.

PART I.

Weeds are now attracting more attention in all agricultural countries because they add considerably to the cost of crop production. A recent survey in America estimated that the average losses each year on farms in Indiana through weeds was $210 and Wisconsin $244.

They cause losses in many ways, but the most important are:—They crowd out more useful plants and rob the soil of fertiliser and moisture which are required by the growing crops. They add to the cost of labour and often affect the quality and quantity of the crops produced. They harbour insect and fungus pests and are sometimes poisonous to men and animals.

Of the many thousands of native plants found in a country fortunately only a few possess all the characteristics of weeds. The weed population, however, of any country where cultivation has been carried on for a long series of years, generally comprises a few native plants and a large number of cosmopolitan weeds which have found their way in from all quarters of the globe. Such cosmopolitan weeds usually possess all the following characteristics. They produce large numbers of seed. The vitality of their seed is retained for many years, especially when buried in the soil. They are able to grow to maturity under a variety of soil and climatic conditions. Their seeds are readily dispersed either by wind, water, or by animals. Many of them are annuals, quick-growing and maturing quantities of seeds even in seasons which would be too short or otherwise unfavourable for cultivated crops. Other kinds of weeds which are perennials spread by seeds and also by underground roots or stems.

Large numbers of such cosmopolitan weeds have already established themselves in this country and every year sees the number increased. In addition to these a number of native plants have assumed the rôle of noxious weeds, and as cultivation is increased a number more will undoubtedly be added to the list. Any strange plant growing in the cultivated lands should be regarded with suspicion, and attempts should be made to hinder its spread.

Because it has never been strictly enforced it is possible that few persons realise the fact that, in 1926 a Noxious Weed Act was passed, and a few of the worst potential weeds were proclaimed noxious weeds. Under the terms of this Act occupiers of land, holders of mining locations and others defined in the Act as "persons responsible" are required to clear, or cause to be cleared, any noxious weeds occurring on the land in respect of which they are responsible.

Weed inspectors may be appointed, and they will be authorised to enter any land, enclosed or not, at all reasonable times, to ascertain if noxious weeds are growing thereon.

If a weed inspector finds a noxious weed or weeds he may serve notice in writing on the person responsible, naming the specific weed or weeds present, and require the person responsible to clear such land within a reasonable time stated in the notice.

The following persons are liable to penalties under the Act:—

Any person responsible who fails to comply with a notice received from a weed inspector.

Any person who obstructs a weed inspector in the exercise of his duty.

Any person who throws a noxious weed or the seed thereof into a river, stream or on to any road or land.

Any person who knowingly sells or offers for sale any plant, seed or grain which is likely to propagate or spread the growth of noxious weeds.

A weed inspector may at all reasonable times enter any premises where any plant, seed or grain is offered for sale,

and may take samples thereof; and should he find any seed, etc., likely to propagate noxious weeds, he may order such material to be treated at the expense of the vendor.

Responsible persons in any district may petition the Government to declare any plant a noxious weed in such district.

It is proposed to deal with all the more important weeds found in the Colony, and with the known poisonous plants in the present series of articles. Farmers can assist in this matter by sending in specimens of weeds which they are not able to identify and by supplying information concerning the distribution and prevalence of unusual weeds in their districts.

With regard to poisonous plants, it has often been stated that the number of deaths due to plant poisoning has increased during recent years. It may be possible, of course, that a number of the cases now suspected as plant poisoning were simply looked upon as poverty in previous years. It is undoubtedly a fact that the greatest number of deaths from plant poisoning occur at the end of the dry season, or just after the first rains. Several reasons might be suggested to explain this; in the first place it has been demonstrated that livestock in poor condition are much more susceptible to plant poisons than animals in good condition. Possibly also the natural discrimination usually possessed by cattle may break down under the stress of starvation. It is also true that during recent years the majority of Rhodesian farmers have attempted to improve their cattle, and it is known that the improved breeds suffer more from our winter conditions than do native cattle, unless supplementary feeding is carried out. A further reason is that a number of the recognised poisonous plants are specially adapted to our local conditions and make an early growth before even the first rains fall. Under these conditions, combined with heavier grazing, if not actual overstocking, such native plants are green before the grass has made a new growth. A further factor is that the improved cattle are not so well acquainted with the local conditions and would probably eat plants which the native cattle instinctively avoid. It has also been proved experimentally that the native

stock requires considerably larger quantities of known poisonous plants to produce fatal results than do improved animals.

These views are in keeping with the experiences in other parts of the world. Losses due to plant poisoning appear to be most serious in the dryer sub-tropical parts of the world. South Africa, Australia and South-Western United States of America all suffer heavy losses from plant poisoning which are much heavier than any experienced in more temperate countries.

It might be thought that the investigation of poisonous plants is a simple matter, and that all that is required is to obtain material, feed it to animals, and watch the results. Unfortunately it is not so simple. The stage of growth is an important factor. Some plants are only harmful in the seeding stage; some only when in fruit; and some only when wilted. In some cases, moreover, the effects are rapid; in others the symptoms do not appear for weeks or months after the plant has been eaten. In a few cases a very small amount of plant substance is sufficient to cause death; in others poisoning does not take place until a large amount has been consumed day after day for several weeks. Evidently in a number of African plants the underground portions, *i.e.*, tubers, bulbs or roots, are particularly poisonous and would undoubtedly cause death in animals if eaten.

It has also been found that a number of plants, which are not generally poisonous, may at least be dangerous under certain conditions. For instance, vegetable marrows and the small kind known as marancas may, under certain conditions, be extremely poisonous. Apparently this only occurs in cases where the marrows are distinctly bitter, and it should be understood that any vegetable marrow possessing this characteristic should not be eaten. It is suspected that only vegetable marrows which have been cross fertilised by one of the wild cucumbers, which are quite common in the sand-veld parts of this country, would possess this poisonous character.

Further, a number of our common grasses have been shown to produce prussic acid in sufficient quantities to be

poisonous to stock when eaten in a wilted state. A few have been shown to contain a considerable quantity even when fresh, but the majority of poisoning cases in South Africa from members of the grass family have occurred in hot dry spells when the grass is only temporarily wilted. Some of the species which have been shown to be particularly dangerous under these conditions are the various Sorghums, including Johnson grass, Sudan grass, and the Kaffir corns. In addition, Red Rhodes grass, Couch grass, Red grass, and young maize have all caused trouble when wilted. It has been found that the amount of prussic acid produced in grasses varies to some extent according to the type of soil upon which the grass is growing, and the extent of the danger of poisoning depends upon the amount eaten. Experiments have shown that small amounts can be fed without serious danger, and this should be borne in mind when feeding Sudan grass or other Sorghums to cattle. If taken in a sufficient quantity prussic acid is a rapid and fatal poison. Unless treatment can be applied before serious symptoms of poisoning have developed it is almost sure to be useless. Sulphur is probably the most useful antidote, and where there is serious danger of poisoning of this nature a sulphur lick should be provided.

Principles of Weed Control.—Before deciding upon a method of control for any weed, one should certainly know its habits of growth and reproduction. In fact, the first question asked is usually: Is the weed an annual, a biennial, or a perennial?

Annuals.—Annual weeds are those which live but one year; they produce seed but once, then die down entirely, root and all. An annual has no part underground by means of which it is capable of spreading; it propagates itself by seeds alone. Obviously, all methods of controlling such weeds have one principal object—*the prevention of seeding*. This end may be attained in a variety of ways—mowing, cultivating, burning, spraying. If seed production is consistently prevented over a series of years, and if the introduction of weed seeds from neighbouring areas is largely eliminated, the annual weed population will gradually decrease. Of course, weed seeds of many annuals may live a number of years in

the soil, and the working of the soil only brings them to the surface, where conditions for their growth are favourable. The germination of such seed should, in fact, be encouraged before the crop is in or is well along, in order to ensure an opportunity to kill the young plants before they are of such size as to injure the crop and to defy easy, inexpensive destruction. Annuals in the early stage are very easily and cheaply destroyed by cultivation and by chemical sprays. Remember that, with annuals, once the top has been destroyed the root has no power of rejuvenating the plant.

One must distinguish between *summer annuals* and *winter annuals*. In the case of *summer annuals*, the seeds germinate in the spring and the plants grow to maturity during the same season, develop a crop of seeds, and die before the end of the year. In *winter annuals* the seeds germinate at the end of summer, or when soil moisture conditions are favourable, and the young plants live throughout the winter in a vegetative condition, often forming a rosette-like growth. The next spring they resume growth, flower soon and shed their seeds.

Winter annuals are effectively destroyed by shallow cultivation soon after they germinate at the end of summer, or they may be killed by this means at any subsequent time. But, the older they get the more difficult and expensive is their destruction; and postponement also increases the chances of some plants going to seed. The value of growing clean cultivated crops, from the weed control standpoint, is that the care normally given then destroys weeds and prevents seeding.

Biennials.—A biennial weed is one which lives two years, producing seed at the end of the second year. It lives through the first winter usually in a low rosette form, producing a crop of seed the second summer, and then dies root and all. The methods of control given for annuals apply to biennials as well.

Perennials.—The most troublesome weeds are perennials, for their control requires special methods and systematic, painstaking endeavour. Plants in this group, as contrasted with annuals and biennials, live three years or more and

spread not only by seed but also by underground roots or stems.

The two chief ways in which perennials are destroyed or held in check, are by prevention of seeding, and destruction of either the underground parts or the top growth of food manufacturing tissue. This latter may be accomplished by mechanical means, such as the hoe, badza, mower or cultivator. Destruction of top growth may also be accomplished by chemical means, employing sprays, such as oils, which merely destroy top growth but may not penetrate the roots or rootstocks. It has apparently been found that in some cases sodium chlorate does poison the whole plant, including the roots.

Prevention of Seeding.- The first and most important step in the control of a perennial weed, in fact of any weed, is of course, the planting of clean seed. This truism should hardly require mention. A second point, which likewise should need no emphasis, is that perennials should not be permitted to mature their seed, even though they spread in other ways.

Clean Cultivation.—As indicated above, perennial weeds have the ability to store in structures underground the food manufactured by the green leaves of the plant. Seeding may be prevented and the top growth kept down by clean cultivation which, if properly done, prevents all of the leaves or food-manufacturing parts of the plant from appearing above the ground. By this means the storage system will eventually be starved out. Farmers must realise, however, that some weeds can in one season store enough food to last them several years. Consequently, one summer of conscientious clean cultivation may be insufficient to exhaust the plants, and the grower may then be disappointed when new growth appears the following spring. The only way to ensure results from clean cultivation is by persistence in keeping down all top growth, which may require several cultivations during one or more seasons. Many tools have been specially designed for this particular method of weed control; special knives can be attached to cultivators, which will cover a given area in a short time, thus cutting down labour and other costs.

Clean cultivation, though it aims primarily at starvation of roots or underground stems of perennials, also continually keeps the soil stirred and brings seeds formerly produced by

weeds to the soil surface where, under favourable conditions, they germinate, the seedlings being killed by subsequent cultivations. Thus clean cultivation serves to bring about a decrease in the number of weed seed in the soil.

Crop Rotation.—In any serious programme of weed control, crop rotation plays a leading part. Among the many well established reasons for such procedure control of weeds is one of the most important. On those farms where weeds are of little consideration, either in increasing labour costs or in decreasing crop yields, a definite plan of crop rotation is systematically adhered to. Planting land to the same crop for a series of years in succession encourages weed growth, and lack of proper rotation is a chief cause of weedy fields.

Chemical Weed Killers.—A number of chemical weed killers have been used with success, including sulphuric acid, copper sulphate, arsenite of soda and many other substances, but Sodium chlorate has achieved such prominence for this purpose that it should be mentioned specially.

The chlorates are white crystalline substances, and are non-poisonous to animals. They have been employed rather extensively in a number of countries and in certain instances very successfully; but in some particulars their use is still in the experimental stage. The results of several workers appear to show that the chlorates are most effective when the solution has an acid reaction. If this be true, chlorate solution should not be made with alkaline water, unless it is rendered acid by adding a small amount of acid. Much more must be learned about the amount to use, the time of application, the relation of time of application to environmental conditions, and method of application, etc. Evidently, however, the chlorates are among the most promising chemicals yet employed to control perennial weeds when applied as a spray to the tops of the plant. They will also effectively kill annuals; but thus far, in most instances, there are other herbicides for annuals more economical than the chlorates and just as effective. As regards perennials, remember that a desirable herbicide is one which, when applied to the tops of the plants will be absorbed and be carried to or result in the death of a large percentage of roots and rootstock.

Time to apply Chlorates.—The chlorates are evidently most effective if applied on mature plants or plants approaching maturity. They should accordingly be applied when the plants are in full bloom, or just after this stage. In the case of perennials a maximum of top growth seems desirable if a large proportion of the underground parts of the plants is to be killed. Late summer and autumn applications seem more effective than those made in spring or early summer. A perennial which develops it seed in the summer may, perhaps, be prevented from seeding more economically by means of cultivation, mowing, oil sprays or some other method less expensive than the use of chlorates, the chlorate treatment being thus postponed until late summer when the plants are becoming dormant. In other words, chlorates apparently bring about a better root kill if applied when the plants are going into the dormant condition.

Amount of Solution Required.—The usual solution employed is that made by dissolving 1 to 2½ pounds of the chlorate in a gallon of water. The amount required depends upon the density and kind of vegetation. If the growth is heavy and rank the dilution can be less than when the growth is moderate or slight; but the amount of spray used must be increased.

Precautions in the use of Chlorates.—In the use of chlorates there is a danger of fire. They are strong oxidising agents; that is, in contact with matter of any sort they readily give up oxygen to it, thus rendering it highly combustible. Thus clothing, chaff, straw, sacks, wood, etc., covered with chlorate will readily ignite when dry. For example, parts of the clothing worn when spraying with chlorine might become wet with the chemical; then the clothing and chlorate become dry and, in this condition, *become highly inflammable.* Ashes from a pipe or a spark from an exhaust pipe of spray equipment may cause a fire.

ALECTRA VOGELII BENTH.

Cow Pea Parasite. Figs. 1, 2 and 3.

Alectra vogelli Benth is a parasite on the roots of cowpeas, and possibly other leguminous plants, very much like the witchweed of maize in habit. It is an erect, hairy plant

Fig. 1.—Above-ground portion of *Alectra Vogelii*, showing flowers and leaves.

Fig. 2.—Flower of *Alectra Vogelii*.

Fig. 3.—Underground portion of *Alectra Vogelii*, showing the swollen root attached to a cowpea root.

up to fifteen or eighteen inches in height often growing as a single stem, but sometimes branched near the ground. Its characteristics are well illustrated in figures 1—3. The flowers are yellow in colour and are from $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter. The seed pods are nearly round and contain large numbers of very small seeds.

The seeds, like those of witchweed, will not germinate in the absence of a host. After germination the small rootlets grow towards the nearest host roots, and proceed to penetrate them as soon as contact is made. At this stage the tissues of the parasite turn a deep orange yellow, and this colour is typical of the whole underground portion of the plant. When penetration of the host root is completed, the subsequent development differs considerably from that of the witchweed, in so far as there is usually a profuse development of roots of both host and parasite at the point of attachment. These roots form a thick ball or clump together with the soil particles, and the presence of these clumps is a good indication that a suspect plant is Alectra (fig. 3).

The effect of the parasite on the host is much the same as in the case of witchweed. Stunting of the crop plants followed by wilting and yellowing indicates the presence of the parasite even before the parasites themselves appear above ground. In the case of peanuts the affected plants generally show a large percentage of blank pods. It usually requires about a month to six weeks after germination for the parasite to reach the surface of the soil, and it is during this time that most of the harm is done.

Owing to the large number of seeds produced and the long time seeds can remain dormant in the soil it is not an easy matter to clear lands of this weed. It has been found to reappear after an interval of six years. Unless leguminous crops which can act as hosts for this parasite are grown on infested lands its seeds apparently do not germinate, and although it has not been recorded in this country on anything but cowpeas, it has been found on French beans and monkey nuts in the Union. Unless the land is heavily infested severe losses are not likely to occur, but since only occasional plants have been noted up to the present, every attempt should be made to eradicate this weed by hoeing out before they flower.

Fig. I.—Burweed.

ARGEMONE MEXICANA LINN.

The Mexican Poppy. Fig. 4.

This plant is one of the few included in the list of noxious weeds gazetted under the Noxious Weed Act 1926. It usually grows to the height of two to three feet and is easily recognised by its silvery grey colour. The leaves are narrow, divided, thistle-like with very sharp prickles and the flowers are poppy-like, cream to white in colour and up to two inches in diameter. The black seeds are enclosed in a capsule up to one inch in length, also covered in prickles.

From observations it would appear that this weed was introduced first to the Bulawayo area. It is common in gardens in town and has spread to the drains cut at the roadside on the Bulawayo commonage. It is extending its range to the north and west and has been received from farms many miles north of Bulawayo. It also occurs in isolated patches on a few farms in the Mazoe area, and an attempt should be made immediately to eradicate this weed before it spreads to greater distances. It should never be allowed to set seed and the young plants should be dug up, dried and burnt.

Sweet Potato Tubers.

Supplies of the best varieties of the above are available from the Agricultural Experiment Station, Salisbury, at 7s. 6d. per petrol case, f.o.r. any station or siding in Rhodesia. The tubers are treated with lime before despatch to ensure delivery in good order.

The following varieties are available and recommended:

Early Butter, Linslade } Highest yielders of tubers.

Calabash.—High yield of tops.

Early Butter, Red Nansemond, Yellow Jersey } Best table varieties.

Information concerning the method of sprouting the tubers was published in the September, 1929, issue of the *Rhodesia Agricultural Journal*.

Commence sprouting after danger of frosts is past. Three cases of tubers will supply slips for planting one acre.

Cheques should be made payable to the Department of Agriculture, and should accompany orders.

WITCHWEED.

By S. D. Timson, M.C., Dip. Agric. (Wye),
Assistant Agriculturist.

Whilst the experiences of a number of farmers in the Maize Belt have been establishing beyond doubt the efficiency of trap-cropping as a means of destroying witchweed, experiments, which have been in progress during the last five years at the Department's Experiment Station at Salisbury, have established the value of certain trap-crops as green-manures in comparison with the standard green-manure crops of the Colony, namely, Sunnhemp and Sunflower.

The results of these experiments are tabulated below. Some of them have already appeared in this journal in an incomplete form. The trap-crops in these experiments were in each case ploughed under after two months growth, except in Series No. 4, when the second crops were not ploughed in by error until July.

SERIES 1.

Plots 1/24 acre. Design:—A Randomised Latin Square.

Treatment during 1929/30.	Yields of following maize crops per acre in bags of 200 lbs. each. Yields per acre. 1930/31.	1931/32.	Average yields per acre over 2 years.	Standard error.
Two crops of Sudan grass ploughed under...	16.74	15.60	16.17	
One crop of Sunflowers ploughed under...	15.84	16.08	15.96	0.30 bag per acre
One crop of common Sunnhemp ploughed under	16.05	17.58	16.81	
One crop of Dwarf Sunnhemp ploughed under...	16.26	16.86	16.56	

Plots 1/24 acre. Design:—4 Randomised blocks of 4 treatments.

$Z = .8306$
for $P = .05$ $z = .5460$
for $P = .0$— $z = .7692$

The results are decidedly significant.

A difference between average yields per acre after treatments (column 3 in above table) of three times the standard error, or .90 bag per acre, may be considered significant.

It will be seen that there is no significant difference between any two of the treatments. The difference between sunflowers and common sunnhemp is very nearly significant, and other experiments carried out at this Station have established the superiority of sunnhemp over sunflowers as a green-manure.*

The fall in yield of maize in the second year after Sudan grass is shown by Fisher's methods of analysis to be statistically significant, and it is thought that the explanation of this fall lies in the smaller weight of organic matter ploughed under in the case of Sudan grass as compared with the other crops as is shown by the table below.

	Common Sunnhemp.	Sunflowers.	Dwarf Sunnhemp.	†Sudan Grass.
Weight per acre of green material ploughed under in lbs....	12,150	13,132	10,374	8,200

Further, these figures combined with the table of results of Series 1, column 1, above appear to indicate that with a given level of mineral plant food in the soil an increase beyond a certain minimum of added organic matter does not bring about a parallel increase in the yield of the maize crop in the following year. At all events, it would appear to be clear that the yield of maize is not directly proportional to the weight of organic matter added to the soil in the previous year.

*Annual Report, Salisbury, Agricultural Experiment Station, 1931-32 (published in this journal June, 1933), by H. C. Arnold, Manager.

†1st crop of Sudan grass only—the weight of material ploughed under in the 2nd crop was almost negligible owing to poor rainfall after sowing (only 1.88 inches fell in February).

In the second year after green-manuring it seems that the greater residue from the greater weight of organic matter ploughed under is now exerting its effect, since after Common Sunnhemp the average yield of maize rose by 1.53 bags per acre, whilst after Sudan grass it fell by 1.14 bags per acre. After Dwarf Sunnhemp and Sunflowers a rise in yield was also registered, though not so great as after Sunnhemp. The maintenance of the yield of maize at such a high general level in the second year is, of course, partly due to the favourable seasonal climatic conditions.

SERIES 2.

Plots 1/20 acre. Design:—Five randomised blocks of 3 treatments.

Treatments. 1930/31. Crops ploughed under.	Yields of maize in bags per acre of 200 lbs. each. 1931/32.	1932/33.	Average yield per acre over 2 years.
Common Sunnhemp (1 crop)	20.07	9.47	14.77
Dwarf Sunnhemp (1 crop)...	21.37	9.90	15.64
Two Crops Sudan Grass... ...	19.08	8.73	13.90

z=.3601
for p=.05 z=.6786

The results are not statistically significant, and there is no significant difference between the three treatments.

SERIES 3.

Plots 1/20 acre. Design:—Five randomised blocks of 4 treatments.

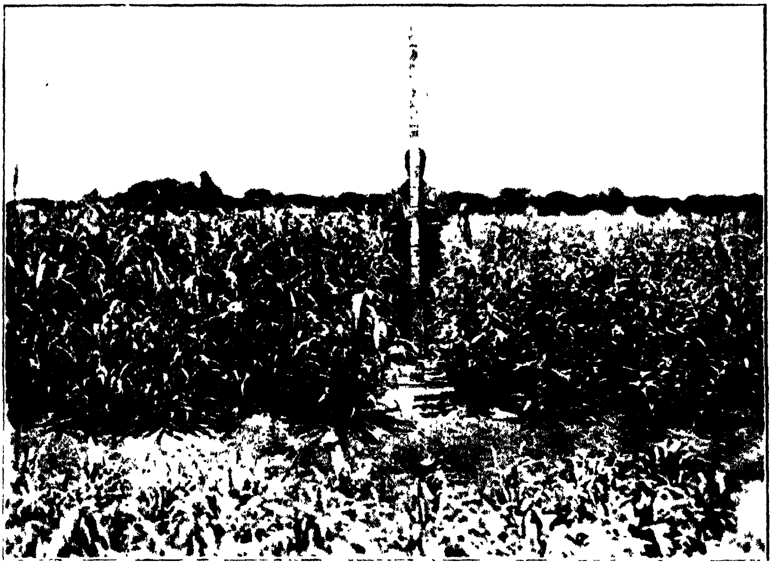
Treatments during 1930/31. Crops ploughed under.	Yields per acre of maize in bags of 200 lbs. each. 1931/32.	1932/33.	Average yield over 2 years.	Standard error.
Common Sunnhemp ...	12.78	17.0	14.89	.52
Dwarf Sunnhemp	11.98	15.80	13.89	bag
2 Crops Sudan Grass...	10.40	14.14	12.27	per
2 Crops Kaffir Corn ...	12.94	14.82	13.88	acre

z=.8373
For p=.05 z=.5508
For p=.01 z=.7757

Maize following two crops of Kaffir Corn and Amber Cane ploughed in
Yield 20.2 bags per acre. Photographed 10th March, 1934.

Right.—Amber Cane grown for seed. Left.—Perennial Native Sudan Grass.

Trap-crops ready for ploughing in.
Left.—White Kaffir Corn (40 lbs. seed per acre). Right.—Amber Cane (25 lbs. seed per acre). Photographed same day as Sudan Grass and Sunnhemp.



Left.—Sudan Grass (20 lbs. seed per acre) ready for ploughing in as trap-crop. Right.—Sunnhemp.

Left.—Amber Cane for Silage. Right.—Wintersome for Silage. Amber Cane yielded over 16 tons of green material per acre.

The results statistically are decidedly significant.

A significant difference between treatment yields over the two year periods (column 3 in above table) may be taken as three times the standard error or 1.92 bags per acre.

It will be seen that the yield of maize after Sudan grass is significantly lower than that after Common Sunnhemp, but there is no significant difference between the other treatments.

The rise in the yields of maize in the second season is due to the more favourable seasonal factor.

The different response to treatment exhibited in the second season's yields of maize as compared with the first season's yields cannot be explained, as no records of the weight of green material ploughed under were recorded.

SERIES 4.

Plots 1/32 acre. Design:—A randomised Latin Square.

Treatment year 1932/33 crops ploughed under.	Yield of maize per acre in bags 1933/34.
2 Crops Sudan Grass	19.64
2 Crops White Kaffir Corn... ...	19.72
2 Crops Amber Cane	20.20
1 Crop Sunnhemp	21.72

$z = .6003$

For $p = .05$ $z = .7798$

There is no significant difference between treatments, and the differences seen in the above table may be due to chance or to sampling errors. A second crop of maize will be grown in 1934/35. It can, however, be reasonably presumed that Amber Cane will not prove inferior to White Kaffir Corn or Sudan Grass as a green-manure, when one considers the evidence of the foregoing experiments with the evidence of the one under consideration.

It should be noted that the second trap-crops were not ploughed under until July, 1933, and the ill-effects of this were apparent at the commencement of the season 1933/34 in the slower growth of the maize following the trap-crops, but passed off later.

CONCLUSIONS.

The results of the above experiments may be briefly summed up as follows:—

1. It is clearly established that the ploughing under of two trap-crops of Sudan grass or Kaffir corn are practically as efficient in maintaining the fertility of the soil as one crop of Sunnhemp or Sunflowers. In Series No. 3 Sundan grass is shown to be significantly inferior to Common Sunnhemp, but it is considered that this result is due to the poor stands of this crop obtained, resulting in a much reduced bulk of organic matter being available for ploughing under.

2. Although Series 4 is not yet completed the results of the first year after treatment indicate that Amber Cane is at least as efficient a green-manure as Kaffir corn and Sudan grass.

3. Although it is not statistically significant, a slight superiority of Common Sunnhemp over the three trap-crops tested is indicated, but further and more complex experiments on the same lines would be necessary to establish this point, which it is thought is not of sufficient importance to warrant this.

It should be noted that no fertiliser was applied to the soil during the course of any of the above experiments.

Green Manure Value of One Trap-Crop.—It may be desirable for a farmer to plant only one trap-crop in a season, and in order to compare the green-manure value of the one trap-crop with that of a standard green-manure crop such as Sunnhemp, a new series of experiments is being laid down this season (1934/35) at the Salisbury Experiment Station. The experiment will be included so that the downward trend of fertility after green-manuring, or trap-cropping, may be also ascertained.

Safety Period between Cultivations and between Sprayings.—Experiments were commenced last year with a view to determining what period may safely be allowed to elapse between one cultivation or spraying to remove witchweed and the next.

The stems of fifty-five witchweed plants in various stages of growth from 4 inches high to the flowering stage were cut just below ground level, and each stem was carefully marked to identify it, and prevent confusion with other parasites approaching ground level.

Of the above 55 plants 27 were growing on Sudan grass in pot culture, 19 were growing on maize in the field, and 9 were growing on Sudan grass in the field. The soil in each case was the typical red clay loam of the Salisbury district.

After the lapse of seven days a number of the plants were commencing to produce new green shoots from the stems just below the points where they were cut.

Only 41 per cent. of the cut plants made new growth, and the first plant to come into flower after cutting did so after an interval of 29 days.

It would thus appear that the ideas previously prevailing, *viz.*, that the parasite came into flower within 10 days after the cutting of the stems during cultivation is incorrect, but more work on this subject is necessary before any definite statement can be made, as there is a considerable weight of evidence from various sources which conflicts with this experimental result.

Spraying the Parasite with Sodium Chlorate Solution.—Further field spraying trials with this material were carried out by Mr. George Bryson on his farm at Amandas during the past season, and the previous results obtained, which have already been reported in this Journal,* were confirmed, namely, that witchweed sprayed with a 1½ per cent. solution of sodium chlorate in water (1½ lbs. per 10 gallons water) was completely destroyed within five to seven days, and no re-growth from below ground of the sprayed plants took place. No appreciable visible damage to the maize resulted. The first crop of witchweed appearing in this trial, together with the weeds present were removed by hand cultivation to facilitate the spraying, and the spraying was carried out on the following crops of the parasite.

Mr. Bryson concurs with the opinion of the writer based on extensive trials* carried out on Mr. A. G. McCall's farm at Glendale, that spraying with sodium chlorate will only be economic in dealing with *moderate* general infestations, or where severe infestations exist in isolated patches, but no records of costs were kept by him.

The Sowing of Trap-crops.—In a previous article† the writer suggested that the broadcast sowing of trap-crops on the maize stubble without previous preparation of the soil, or with merely a disc-harrowing previous to sowing, might be tested by farmers owing to the economy of this method. During the last season several farmers tested this method with both Amber Cane and Kaffir Corn and found it quite successful, but more information on this matter would be welcomed by the writer.

Prussic Acid Poisoning by Sorghums.—The danger of the poisoning of stock by the injudicious feeding of green sorghums has already been referred to on several occasions in this journal by the writer, and he thinks that the following practical farm test for the prussic acid content of sorghum will be of interest to farmers who are growing them as trap-crops or for feed purposes only, and they may wish to try it out for themselves.

The test has been designed and confirmatory trials made by the author of an article which appeared in the *Indian Journal of Agricultural Science*, in which they give the results of their interesting and valuable research on the "Development of Prussic Acid in Kaffir Corn.‡ They state that it has given dependable results in actual use.

Cut a thin transverse section of the stem near to the bottom node or joint. Stain this with a solution of iodine. If the tissues are stained blue or black as seen by the naked eye, then they contain over .1 per cent. of prussic acid and are dangerous to feed to stock.

If no staining by the iodine is observed and the section is quite clear then the crop is safe to feed to stock.

**R.A. Journal*, January, 1933, Witchweed Control, by S. D. Timson.

†*R.A. Journal*, December, 1933, Witchweed, by S. D. Timson.

‡*Indian Journal of Agricultural Science*, October, 1933. "Development of Prussic Acid in Kaffir Corn," by C. N. Acharya.

The test was based on the fact demonstrated by the authors that the accumulation of starch grains in the tissues of Kaffir corn is correlated with the formation of prussic acid. It cannot, of course, be stated with certainty that the same correlation holds good in this Colony or with all varieties of sorghums, but this is probable.

Amber Cane as a Trap-crop.—Another season's experience with this crop has served to confirm the good impressions already formed of its great value as a trap-crop for witchweed, and it can be strongly recommended for this purpose.

The following points can be advanced in its favour:—

1. Series 4 of the experiments described above, together with the results of the other series quoted, indicate that two crops ploughed under in the season are as effective as a green-manure as a crop of Sunnhemp.

2. It is an excellent host crop of witchweed.

3. A seeding rate of only 20 to 25 lbs. per acre is required for trap-cropping as compared with 40 lbs. per acre with Kaffir corn, and it appears to give about the same seed yield in the maize belt as the latter crop.

4. When grown for seed it is comparatively bird-proof compared with Kaffir corn.

5. A stand is more easily obtained in the field than with Kaffir corn.

6. It is still uncertain whether all the White Kaffir corn varieties in the Colony are good hosts of witchweed, but in the case of Amber cane this uncertainly does not exist, and only one strain, which is known to be a good host, is grown here at present.

7. It is a more palatable stock feed than Kaffir corn, and makes a finer hay than that crop, and is easier to make into hay. It is an excellent silage crop. In trials carried out at the Salisbury Experiment Station during 1933/34 it yielded 13¼ tons of green fodder per acre, when planted in 24 inch rows, and higher yields are probable with closer spacing.

Smut in Kaffir Corn and Amber Cane.—When sown for seed these crops are rather liable to attack by the fungus disease of the ears known as "Smut." This trouble may be easily prevented, however, by treating the seed before sowing with Ceresan New, the dust which has taken the place of Tillantin for the prevention of Diplodia infection in seed maize. The treatment is simple and the cost negligible.

About 3½ to 4 ounces of Ceresan New per 112 lbs. of seed will suffice, and the price is 3s. per lb. The cost per acre planted at a seeding rate of 4 lbs. per acre is less than a halfpenny.

The treatment of the seed should be carried on for 5 minutes.

Resistant Trap-crops.—Saunders, in his admirable *"Studies in Phanerogamic Parasitism," p. 54, points out the possibility of using one of the partially resistant strains of Kaffir corn as a trap-crop. He is endeavouring to breed a perfectly resistant type, and says: "Perhaps the greatest value of resistant types would lie not so much in their ability to produce good yields on infested soil as in their power of actually destroying witchweed, thereby cleaning the soil for other crops. Field experiments as well as laboratory tests have shown that the resistant kinds of sorghum excrete the activating substance as liberally as the susceptible ones.* Very few parasites appear above ground on the former, however, and provided these few are prevented from seeding—the number of witchweed seeds in the soil must become rapidly decimated."

Munga or Nyouti, one of the millets grown widely by natives in this Colony, falls in another class, since it is, according to Saunders, truly "immune," in that although the parasites attach themselves to its roots "they never flourish," "nor have full-grown parasites been found upon its roots,"

*Published as Science Bulletin No. 128, Union of South Africa, Dept. of Agriculture, by A. R. Saunders.

and after germinating they die off. It would appear that Munga might be used as a rotation crop with advantage on infested farms and grown for seed, thereby destroying a proportion of the witchweed, and at the same time yielding a crop of seed which can be used for sale or for feeding to poultry or cattle. Its value as a poultry food is well known, and it is also a valuable feed for fattening cattle if fed not whole but "cracked." The grain contains 11.37 per cent. protein compared with 9.4 per cent. in dent maize, and the nutritive ratio is 1:7.3 compared with dent maize 1:9.1†

†Analysis of Rhodesian Foodstuffs, by Division of Chemistry, *Rhodesia Agricultural Journal*, Sept., 1934.

Export of Frozen Pork.

Arrangements are being made by the Department of Agriculture to export one or more consignments of frozen pork to Great Britain before the end of this year.

First quality, well fed porkers of 80-100 lbs. liveweight are required, and farmers interested in the experiment should communicate as soon as possible with the Secretary, Department of Agriculture, P.O. Box 387, Salisbury. Suitable pigs will be purchased outright by the Department at the ruling rates for first quality porkers.

Pigs will be inspected on the farm prior to purchase and, to save expenditure, preference will be given to farmers in the vicinity of Salisbury and Bulawayo or close to rail.

SOUTHERN RHODESIA

Official Egg Laying Test, 1935.

The next test will commence March 1st, 1935. Entries close 18th January. Full particulars, rules and entry forms can be obtained on application to the Chief Poultry Officer, Department of Agriculture, Salisbury. Single pen accommodation is provided. Intending competitors are requested to make early application.

Annual Report of The Chief Animal Husbandry Officer.

1933.

This has been an important year for the cattle industry.

Export of Chilled Beef.—The major development has been the commencement of a trade in the export of chilled beef to the United Kingdom. Two experimental shipments were sent early in the year, with promising results, and since May there have been continuous weekly shipments to Smithfield, totalling approximately 23,000 head of cattle for the year.

The prices realised have not been wholly satisfactory from the standpoint of the producer, but the Government bounty on chilled beef has enabled the trade to be carried forward at a fair profit, and has had the effect of stabilising the local prices of cattle at a fair level, considering conditions.

Grass-fed chilled beef has sold at considerably lower prices than chilled beef from the Argentine, but selected consignments of stall-fed beef have sold very satisfactorily up to within ½d. per lb. of the average Argentine price for sides, some hindquarters reaching 6⅝d. per lb.

Standard of Beef Exported.—There has been some difficulty in arriving at the lowest quality of chilled beef which should be passed for export to the United Kingdom. Early in the year it was realised that, as far as possible, it was desirable to maintain a uniform standard of export from the whole of South Africa. A conference was held in Pretoria in January to determine the standards for export. To meet the difficulties of this Colony and adjoining territories which had large surpluses of cattle to dispose of and no sufficient local market inside their own boundaries, it was decided to adopt a moderate standard of quality, the terms of which were drawn up at this Conference, and all represented territories agreed to abide by this decision.

An inspection service was instituted at Bulawayo and all chilled meat which did not come up to the standard set for export was rejected. To start with, this service was unpopular, but as a better understanding of the quality requirements was gained by exporters, its necessity and usefulness were generally appreciated.

Marketing of Beef Overseas.—The Chief Animal Husbandry Officer spent two months in England investigating the market of chilled, frozen and other forms of beef, and following closely the disposal of the weekly consignments arriving during that time.

This investigation showed clearly that most of the grass-fed chilled beef exported was below the quality required by the English market, and though saleable, the prices realised for the meat were not likely to cover costs of production and marketing under present conditions.

A full report on the marketing of the meat has been furnished elsewhere, but it is not out of place to call attention here to the excellent work that has been done by The Rhodesia Export & Cold Storage Company in this Colony, and the Stock Breeders' Meat Company in England, in developing the market in the face of the depressed times and the unfavourable season.

To build up a permanent Trade and to widen the demand for Rhodesian beef, it will be essential to improve on the quality of the meat which has hitherto been exported. The main objection of the Trade at present to Rhodesian chilled beef is the lack of quality or finish. This was demonstrated forcibly during the visit of the Chief Animal Husbandry Officer, when experimental shipments of chilled beef arrived from Australia and South Africa of cattle similar in conformation to those shipped from this Colony but which had had supplementary feeding and were well covered with fat, sold at approximately 1d. per pound more for sides than the chilled beef from this Colony.

Policy of the Department.—As a result of this visit, the policy of the Department has been to emphasise the value of feeding, and to persuade farmers to feed their bullocks before they are sold for export. This policy was strikingly justified

by the Christmas shipment of beef from the Matopo Estate. This consignment consisted of ordinary good ranch steers, which had had a period of feeding of from one to three months. These cattle sold at within ½d. per lb. of Argentine chilled meat, while ordinary grass-feds met a moderate demand, the prices realised being:—

Special stall-feds	4.18d.	per lb.	for sides.
Ordinary stall-feds	3.21d.	,,	,,
Grass-feds	2.65d.	,,	,,

Experimental Work: Rhodes Matopo Estate.—The development of the chilled beef trade has produced a crop of problems. A solution for many of these must be found before the trade can be placed on a sound economic basis. During this year, therefore, a large amount of experimental work has been commenced at the Rhodes Matopo Estate. This work should be of great value to farmers in the Colony.

Experiments have been started to study:—

(1) The economic feeding of weaners during their first and second winters, as it is during this period that most cattle receive a serious check with a resultant loss of quality and maturity.

(2) The feeding of supplmentary minerals to cows rearing calves, growing stock, and fattening cattle to determine the value of phosphatic supplements, salt, etc., under local conditions.

(3) The cost of production of export chiller steers under various systems of management such as: free range, semi-intensive and intensive forms of management, and the production of "baby beef."

(4) The fattening of steers on grass and in pens with rations readily available to the Rhodesian farmer.

In many of these experiments the Rhodesian Cold Storage and Supply Company is co-operating by supplying cattle, and in some cases, the feed as well.

Supply of Store Cattle for Fattening.—An economic problem awaiting solution is the best method of bringing the breeder of steers and the agriculturist together so as to produce stall-fed cattle for export. The question has been complicated this

year by the bounty. As long as there is sufficient bounty to make the export of grass-fed cattle profitable to the producer it is unlikely, under our conditions, that the maize grower will get bullocks cheap enough to make them profitable to feed for export.

It is unfortunate that the bulk of the steers suitable for feeding are produced in the southern end of the Colony, a long way from the feed, which means that they have to be brought north for fattening and sent south again for slaughter and export. From the farming standpoint it is desirable to feed the bullocks where the feed is grown. By so doing, the manure is made where it is required and a desirable system of mixed farming is made possible. At the moment the tendency, however, is for the breeders to buy the feed and fatten their own bullocks. This tendency is likely to continue for some time, and it is not clear yet whether a settled trade in stores can be developed between Matabeleland and Mashonaland. A further complicating factor is that, in the event of the export of chilled beef developing from the port of Durban, the logical outlet for the ranch cattle in the south will be via Beit Bridge and Durban for export as grass-feds, or for fattening within the Union of South Africa.

The fattening of beef cattle in Mashonaland is an industry with possibilities, and it may, therefore, be necessary for the Mashonaland farmer to produce most of his own bullocks for fattening, and for this purpose the areas east and north of Salisbury are very suitable if the cattle are managed on proper lines.

Liebig's Extract of Meat Company.—During the year Liebig's Extract of Meat Company opened a factory at West Nicholson for the manufacture of extract. This factory should play an important part in ridding this Colony of the native and "scrub" type of cattle. There is a very poor demand overseas for all classes of beef unsuitable for chilling, and it may be necessary to very much increase the capacity of this factory and to build other factories of similar description in the Colony to get rid of the increasing surplus of cattle.

Pure-bred Cattle.—Owing to the uncertainty of the beef market, the demand for beef bulls has been poor and breeders

of pure bred beef cattle, with the exception of the Africander, have had an unsatisfactory year. The quality of the general run of beef cattle in the Colony is on the down grade. The continued lack of demand for pure bred beef bulls is driving a number of breeders out of business, which is particularly unfortunate at a time when the chilled meat trade is just starting. The dairy breeds, on the other hand, have done very much better, and the demand for Friesland, Red Poll and Ayrshire bulls with milk records has exceeded the supply.

Breeding Policies.—An interesting development during the year has been the discussion at farmers' meetings of the possibility of applying a cattle improvement scheme to this Colony similar to those in operation, or to be put in operation, in Great Britain and Ireland. The general feeling has been that such a scheme is premature at the moment, but it is felt that sooner or later something on the lines of the scheme referred to will be necessary to supplement the work of better feeding and further improve the quality of cattle for export.

The question is complicated by the fact that no imported beef breed has yet proved itself adapted to ranch conditions in this Colony and that there is still a lack of agreement as to the best breeding policy to be followed in grade herds running under ranch and semi-extensive conditions. The stock has been "graded up" too far for prevailing conditions, and the majority of the large herds are now in the phase where a change in the breeding policy and/or management system must be made to arrest deterioration. The problem is further complicated by the general financial insecurity of most cattle farmers who cannot afford any drastic change.

In the present phase of the cattle industry this Division is advocating a more widespread use of Africander bulls under ranching conditions. It is hoped by so doing to counteract the prevailing deterioration to provide a foundation from which to select either an indigenous type in harmony with the environment or, possibly, to provide a suitable reservoir of hardy, indigenous type of cows to produce vigorous first cross stock for slaughter when bred to imported bulls. In this case both male and female FI progeny should be sold.

The problem is an involved one, and a breeding station to study it from the genetic and economic standpoints would be

a national asset. Though the output of such a station might have little effect in the lifetime of this generation, the leaven of the results could well influence the whole breeding policy of the Colony.

The problem of the small beef cattle farmer with adequate feed resources is simpler. For the present he is certainly advised to persist in breeding rationally to good bulls of an imported beef suited to his conditions

The growth of the milk recording scheme and the activities of the dairy officers have materially raised the standard of dairying in recent years.

Here again a note of caution should be sounded. At this formative stage of the industry there is a tendency for breeders to concentrate on milk yields to the neglect of constitution and adaptability. A rational balance must be maintained between the cow and its environment. A stage can be reached where increased production per cow requires an uneconomical amount of feed and attention under prevailing conditions.

The matter deserves wider consideration than it has received hitherto, and I consider that an economic survey of dairy farming in the Colony is very much needed to determine generally the levels of production suited to our varying conditions.

Export of Frozen Porkers.—A consignment of porkers for export has been got together and will be exported at the end of January next. This shipment is planned to gain information on the suitability of good average maize fed pigs in this Colony as frozen porkers for the United Kingdom trade, and to determine the efficiency of the transport and marketing arrangements.

To put mixed farming on a sound basis in this Colony it will be necessary to make the pig a far more important animal than it is at present. There is not a great deal of real interest taken in pigs in the Colony, and the results of this shipment should stimulate interest and, it is hoped, make possible some concrete proposals for the development of the industry.

There was considerable difficulty in securing the necessary pigs, which illustrates the instability of the industry. When the shipment was first planned, suitable porkers were offered at $2\frac{1}{2}$d. per pound live weight. By the time arrangements for export were completed some four months later, one of the periodical scarcities of pigs had arisen and it was necessary to pay $5\frac{1}{2}$d. per pound live weight for similar pigs, thereby removing the chance of profit on this particular shipment.

Extension Work.—Extension work has suffered this year owing to the absence overseas of the Chief Animal Husbandry Officer and also to a certain extent through lack of funds. It is hoped to make considerable improvement in this respect next year, and one additional officer, Mr. R. H. Fitt, will be appointed from the beginning of January.

Market Conditions.—Considering circumstances, market conditions have been satisfactory this year:—

(a) *Cattle.*—"Grass-fed" cattle for export have been purchased at from 14s. to 16s. per 100 lbs. dressed weight, and "Stall-feds" for 20s. to 22s. The local market closed strong at the end of December, good "grass-feds" selling at 17s. and 18s. and "stall-feds" up to 22s. and 23s. Except for a short period early in the year good grass-fed cattle have met a reasonable market throughout. On the whole the market at Salisbury has been better than those in the Midlands and Bulawayo.

(b) *Pigs.*—The market has been extremely variable. The price of baconers has varied from $2\frac{1}{2}$d. to $5\frac{1}{2}$d. per pound live weight for pigs of similar quality. The year closed with a shortage of pigs which will probably be removed in the course of the coming year, with a proportionate drop in prices. This unstable condition of affairs is likely to continue and prevent any substantial expansion of the industry until an export trade is developed.

Considerable interest has been shown in the stabilisation of the pig industry in Great Britain, and farmers in this Colony have been active in discussing the repercussions of the policy. It is not unreasonable to believe that some modification of the action taken by the British Government may be necessary to build up an industry in this country.

There is a fairly general demand amongst pig farmers for the development of a Government grading system of pigs slaughtered at local factories similar to the system in operation for dairy products. This Department has no official relation with the bacon factories such as it has with the creameries or the Rhodesian Export and Cold Storage Co., and it is difficult to secure definite information on many of the points raised. In general, however, I feel that such a system of grading can do no harm but much good.

(c) *Dairy Products.*—The local market has been good. The overseas market has been poor, but under the conditions obtaining this year local producers were not greatly affected by the overseas market.

(d) *Sheep and Wool.*—This season has been marked by a welcome rise in the price of wool. Owing to the drop in imports of slaughtered sheep from the Union of South Africa, there has been a shortage of mutton in this Colony, and fat sheep have commanded a very ready market. Kaffir sheep have sold for as much as £1 per head for slaughter purposes. This year has gone further to prove that, as a side line, the sheep is a very profitable animal. The farming of sheep on a larger scale is still, however, not on a proper foundation in this Colony, losses being far too great. In this respect the appointment of Mr. R. H. Fitt, an officer with a training in sheep and wool, should be of great value.

It is hoped to undertake considerable experimental work in the production of cross-bred mutton lambs and the field control of internal parasites in sheep during the coming year.

Annual Report of the Chief Dairy Officer
1933.

Dairying Season.—The dairying season 1932-33 was characterised by a rainfall below normal; the season commenced auspiciously with heavy early rains, but these were unfortunately followed by a prolonged dry spell from which certain areas, particularly in Matabeleland, suffered rather severely; in fact, very little rain was received over the country as a whole after the end of January, with the result that production received a severe check—in fact, with the exception of cheese, the output of dairy produce during the period under review was very much below that of the previous year. The following figures show the production of butter and cheese during the past three years.

Production of Butter.
(Creamery Butter only.)

1931.	1932.	1933.
1,401,085 lbs.	1,464,706 lbs.	1,114,982 lbs.

Production of Cheese.
(Farm and Factory Cheese.)

1931.	1932.	1933.
165,000 lbs.	277,073 lbs.	281,981 lbs.

Dairy Stock.—The treatment of dairy stock continues to receive attention and a definite improvement in this direction can now be reported; the provision of winter feed for milking stock and the feeding of concentrates is also becoming a more general practice. There is still room for improvement, however, in regard to the condition under which cows are milked and housed; the latter are still too often milked in an open kraal with all its attendant discomfort in wet weather; the attitude of farmers who persist in these practices is difficult to understand, as they are in most cases fully aware of the benefits to be derived from a milking shed, etc.

Dairy stock are still in good demand and prices varying from £10 to £15 have been realised for good grade cows.

Numerous enquiries have been received for dairy bulls, and in this connection attention must be called to the fact that it is becoming increasingly difficult for our farmers to obtain good herd sires; the fact is that quite a number of our dairy herds have been graded up to a fairly high standard and bulls with really good milk and butterfat records are now required to maintain the standard of production and quality which has been attained; bulls of this description are not procurable locally and will have to be obtained elsewhere. It is felt this is a matter which requires early attention, and the suggestion is therefore offered that arrangements might perhaps be made with the Breed Societies in the Union for the introduction of a number of suitable bulls for sale at the forthcoming Agricultural Shows.

Milk Recording.—The milk recording scheme continues to be well supported, the total number of herds brought under test during the year was 44; five of these have now been withdrawn, leaving a total of 39 herds, which is a slight increase over the number tested during the previous season. Exact figures in regard to the number of cows tested during the year are not available; it is estimated, however, that the figure would exceed 1,500, and this represents an increase of about 15 per cent. over the number tested during the previous year.

The average annual production per cow in the grade herds tested is shown in the following. (These figures are compiled only in respect of those cows which completed lactation by the 30th November, 1933; for the sake of comparison the figures for the previous year are also given.)

	No. of cows.	Milk. produced in lbs.	B. Fat produced in lbs.	Average % B. Fat.	Av. No. of days
1932	479	3,694.00	138.57	3.75	224
1933	891	4,190.30	157.10	3.75	256

The average production of the grade herds recorded during the period under review thus shows a considerable improvement over the figures for the previous year and may, in view of the abnormally dry conditions which obtained, be regarded as very satisfactory. Milk recording has undoubtedly raised the average production of these herds, but the results

will probably be even more striking in the future now that the cattle market has been re-opened and farmers are able to dispose of their unprofitable cows.

Creameries—Butter Production.—The number of creameries required to be registered under the "Dairy Produce Act" stands at the same number as last year, *viz.*, eleven.

On the whole our creameries are now fairly well equipped and compare very favourably in this respect with factories operating in the Union and other neighbouring States.

As previously stated, the creameries had a rather short season and the output of creamery butter fell below that of the previous year by approximately 350,000 lbs., or a decrease of about 24 per cent. It is of interest to note that whilst this was the overall decrease in output, the percentage decrease in the quantity of second and third grade butter manufactured amounted to barely 8 per cent., *i.e.*, the quantity of low grade butter manufactured remained practically the same; in fact, there was a small surplus of these grades which was finally disposed of on the Union and overseas markets.

On the other hand there was a definite shortage of first grade butter which was made good by importation from New Zealand and Australia; 42,000 lbs. of butter was imported from New Zealand for consumption within the Colony, whilst a further 150,000 lbs. was introduced from Australia for the Northern trade. A short season similar to that experienced here occurred also in the Union, and the latter territory was also importing butter at the end of the year. As a result of the butter shortage cream prices rose considerably, and first grade butter-fat was actually realising 1s. 8d. per lb., a figure which it had not reached for nearly three years.

Whilst the output of creamery butter showed a marked decrease the quantity of farm butter made during the period under review was practically the same as that manufactured during the previous year and approximated half a million pounds. This is an unsatisfactory state of affairs from the standpoint of the dairy industry as a whole.

As indicated above, the proportion of low grade butter manufactured during the year was higher than that of the previous season; the figures are as follows:—

Year.	1st Grade. %	2nd Grade. %	3rd Grade. %
1932	67.30	19.90	12.80
1933	61.90	21.90	16.20

The percentage of first grade butter does not appear to be unduly low, but unfortunately a considerable proportion of the butter sold as first grade would not on examination stand up to its reputed grade of quality. This is not entirely the fault of the conditions under which the butter is manufactured, but is to be attributed very largely to the conditions, etc., under which the cream is produced on the farms.

The grading of the butter at the creameries was carried out as a regular routine during last year and considerable quantities of butter were degraded.

As previously stated a small consignment of butter was exported overseas and the official reports thereon were by no means discouraging and indicated that the standard of grading adopted here compared very favourably with that practised overseas.

Some of the butter included in this consignment was actually accepted as "First Grade" by the London buyers.

Cream Supplies.—As indicated elsewhere the quality of the cream received at the creameries shows no improvement over that produced in previous years; this is indeed regrettable, and it is feared that unless a very great improvement is effected in this direction it will be very difficult to build up a dairy industry in this territory. The introduction of corrective measures in the form of legislation under which some degree of control can be exercised over the conditions under which milk and cream is produced on the farm is imperative.

Testing and Grading of Cream.—Very few complaints have been received as far as the testing of cream is concerned. Considerable dissatisfaction has been expressed, however, by producers regarding the grades returned for cream supplied to the creameries, but on investigation it has generally been found that the cause of the trouble lay in the conditions, etc., under which the cream was produced and handled on the farm.

Cheese Factories.—Cheese Production.—The number of cheese factories required to be registered under the "Dairy Produce Act" during the year under review showed an increase of three over the number registered during the previous year, *i.e.*, seven factories were registered whereas only four concerns were operating in the year 1932.

As indicated elsewhere, the total quantity of cheese manufactured showed an increase over that of the previous year and constituted a record for the Colony.

The expansion which has taken place has no doubt been stimulated by the high prices ruling for cheese. These have been maintained at a high level, with the result that cheese-making has proved more remunerative than selling cream to a creamery.

It is gratifying to be able to report that the quality of the cheese manufactured during the period under review has shown a decided improvement over that produced in any previous year. This improvement in quality has undoubtedly been effected by the means of compulsory grading, a measure which was introduced early in the previous year.

The percentage of the different grades of cheese manufactured during the year under review were as follows:—

First Grade	52.3%
Second Grade	37.5%
Third Grade	7.0%
Below Grade	3.2%

These figures may not appear to be very satisfactory, but it should be borne in mind that a certain proportion of the cheese graded as second grade is of reasonably good quality; in fact, it is estimated that at least 70 per cent. of the local manufactured is suitable for table use. It should not, however, be difficult for our cheese makers to improve on these figures.

It is of interest to note that the Cheese Stabilisation Association, which was formed with the object of eliminating price-cutting and under-selling in the local market, has managed to continue its operations and has up to date proved an unqualified success.

Markets.—No difficulty has been experienced in disposing of locally made cheese. The latter has found a ready sale in the Colony, and exports to adjoining territories show an increase over the quantity exported in previous years; in fact, notwithstanding the marked increase in production referred to above it was found necessary to import a small quantity of cheese from overseas towards the end of the year.

In the case of butter, the Colony was faced with a shortage and reference has already been made to the fact that importation from overseas was necessary.

Overseas prices for both butter and cheese showed a decrease compared with those ruling during the previous year; this decline in overseas values followed as a result of the increase which took place in the quantity of dairy produce imported into the United Kingdom. Unfortunately, there appears to be little prospect of any immediate improvement in overseas prices. The levy and bounty scheme operative under the Dairy Industry Control Acts adopted in this and adjoining territories has prevented local prices for dairy produce from dropping to export parity, but this state of affairs cannot be maintained indefinitely, and it is sincerely hoped therefore that overseas values will improve to some extent at least in the near future.

Southern Rhodesia Veterinary Report.

AUGUST, 1934.

AFRICAN COAST FEVER.

The mortality at the Greyling centre, Charter district, was 7. The disease was diagnosed at Riversdale, south of Greyling, where four herds dip. The mortality was 14.

FOOT AND MOUTH DISEASE.

The disease was discovered amongst some native cattle south of Gwanda and on the Tokwe, both within the cordoned area. Otherwise there has been no extension of the disease.

TRYPANOSOMIASIS.

Six cases in Hartley district and six on Melsetter border.

TUBERCULIN TEST.

Eighty head of cattle were tested on importation with no reaction.

MALLEIN TEST.

Thirteen horses were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa:—Cows 72, heifers 7, bulls 2, horses 13, sheep 326.

EXPORTATIONS.

To the United Kingdom *via* Union Ports in Cold Storage: Beef quarters, 3,496; boned quarters, 1,505.

Meat Products from Liebig's Factory:—Beef powder, 23,910 lbs.; meat extract, 23,469 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 22. September, 1934.

Swarms of the Red Locust (*Nomadacris septemfasciata* Serv.) have been in evidence throughout the month, particularly in the eastern and north-eastern districts of the Colony. A feature ot the reports received has been the great size and density of some of the swarms observed.

One swarm in the Mazoe district is described as easily the biggest that has ever been seen in the district. It commenced passing over one point in the early morning of the 23rd, and at 1 p.m. on the 24th was still passing over.

The direction of flight has been irregular, and no definite migratory tendency has been evidenced, in spite of the fact that a definite invasion *via* Northern Rhodesia took place in August.

As in previous experience, swarms have continued to haunt the humid Eastern Border districts, crossing the border freely to and from Portuguese East Africa. The presence of swarms has, however, been reported as far west as the Wankie district, and as far south as Chibi and Insiza districts, all of which are in distinctly or comparatively dry areas. Salisbury township has suffered several visitations during the month.

To the end of the month there was no sign of development of the ovaries in the females.

Enemies and Disease.—Nothing has been recorded under this heading. All specimens examined during the month have been healthy and free from both parasites and disease.

Damage.- Damage to native trees, plantations of exotic trees, fruit trees, early grazing and irrigated crops has been reported from various districts.

Outlook.—The prospect for the coming season in regard to prevalence of hoppers, based on prevalence of winged locusts in the Colony and reports from neighbouring territories, has become decidedly grave, and it appears highly doubtful if the peak of the present swarm cycle of the Red Locust has as yet been passed, even in Southern Rhodesia.

R. W. JACK,
Chief Entomologist.

SALES.

Agricultural Experiment Station, Salisbury

Spineless Catcus Slabs (blades) Algerian variety, per 100 Slabs 7/6 delivered at the Salisbury Experiment Station, or 10/- delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Kudzu Vine Crowns, per 100 Crown 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns during November and December.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbury.

Southern Rhodesia Weather Bureau.

SEPTEMBER, 1934.

Pressure.—The mean monthly pressure was generally very high, being highest in the south and south-east.

Temperatures.—The mean temperature for the month was generally well below normal. Night temperatures were particularly low at the beginning of the month and again towards the end.

Accuracy of Pressure.—The majority of barometers have been carefully tested within the last few months and the following corrections are applicable from July, 1933, to August, 1934:—

Enkeldoorn	+0.2 mb.
Fort Victoria	+0.3 mb.
Gwaai Siding	—0.2 mb.
Gwanda...	+0.2 mb.
Hartley	—0.9 mb. (prob. unreliable)
Plumtree	+0.4 mb.
Que Que...	—0.3 mb.
Wankie...	—0.2 mb.

The remaining barometers, with the exception of Miami, Sinoia and Sipolilo, are correct to 0.1 mb.

SEPTEMBER 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum	Dew Point	Cloud Amt	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min	Max	Min.	½ Max Min	Normal	Dry Bulb.	Wet Bulb.	%	F	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	95	48	81.2	58.1	69.7	70.9	67.1	58.5	60	53	...	0.64	0.14	4	...
Beit Bridge	969.6	...	102	42	84.1	55.6	69.9	..	69.4	58.6	53	51	2.0	0.06	0.18	1	1,500
Bindura...	895.1	...	93	41	80.0	55.1	67.5	..	66.0	56.0	54	48	1.5	0.14	0.13	1	3,700
Bulawayo	871.9	870.5	92	37	76.6	51.7	64.1	67.5	63.5	52.5	49	43	3.1	...	0.17	..	4,426
Chipinga	890.5	...	90	43	73.6	52.3	62.9	..	62.7	55.1	66	50	3.3	0.90	0.79	10	3,685
Enkeldoorn	861.0	...	91	35	74.4	48.9	61.7	67.0	61.7	53.1	59	47	1.4	0.50	0.14	3	4,788
Fort Victoria	899.9	897.6	94	37	77.4	50.1	63.8	66.1	64.6	55.4	58	48	2.4	0.02	0.21	1	3,571
Gwaai Siding	907.1	.	99	35	86.7	52.7	69.7	...	64.3	54.4	53	47	1.5	...	0.17	...	3,278
Gwanda	910.0	..	95	37	79.2	53.6	66.4	...	64.9	54.8	55	47	2.8	0.03	0.16	1	3,229
Gwelo	865.9	..	92	39	75.9	50.1	63.0	67.4	62.8	52.9	54	45	2.1	0.02	0.17	1	4,628
Hartley	888.7	...	96	41	82.2	52.3	67.2	70.1	65.1	54.9	52	47	1.8	0.05	0.13	1	3,879
Inyanga	839.4	...	85	32	70.6	49.2	59.9	...	62.0	52.1	51	43	1.6	0.16	0.24	1	5,514
Marandellas	840.6	..	85	39	72.4	49.4	60.9	...	59.9	51.1	56	43	2.5	0.25	0.27	1	5,452
Miami	881.8	..	90	42	79.5	53.8	66.6	..	66.6	55.5	49	47	1.1	0.18	...	1	4,078
Mount Darwin ...	911.0	...	95	40	81.9	54.7	68.3		68.4	59.7	61	54	2.2	0.02	0.06	1	3,180
Mount Nuza	804.5	...	80	33	60.2	44.6	52.4	...	51.5	46.5	73	42	4.6	1.40	...	7	6,668
Mtoko	880.8	...	91	41	78.0	54.2	66.1	...	66.4		...	..	1.3	...	0.02	...	4,140
New Year's Gift...	...	...	96	45	80.2	54.0	67.1	70.1	64.4	57.4	65	52	.	0.40	0.25	5	2,690
Nuanetsi	967.5	...	101	38	83.9	52.4	68.1	...	71.1	59.4	53	52	3.1	0.06	0.21	1	1,580
Plumtree	867.6	...	91	38	77.6	53.9	65.7	..	64.9	52.5	44	42	1.8	...	0.03	..	4,549
Que Que	885.2	...	92	41	79.9	53.0	66.4	...	65.5	54.8	50	46	1.7	0.41	0.07	2	3,999
Rusape...	865.8	...	90	35	73.4	47.6	60.5		60.2	52.2	60	46	2.5	0.20	0.14	1	4,647
Salisbury	857.8	856.6	89	37	77.2	50.7	63.9	66.6	63.8	53.2	49	45	1.9	0.28	0.27	4	4,885
Shabani	911.9	...	96	46	78.9	56.1	67.5	.	65.2	56.5	61	51	3.2	0.07	0.24	1	3,193
Sinoia	891.2	...	93	38	82.1	50.5	66.3	...	68.2	57.2	51	49	0.4	0.57	0.19	3	3,794
Sipililo	888.2	...	91	40	78.6	56.0	67.3	...	66.7	55.4	49	46	1.1	0.27	0.10	2	3,876
Stapleford...	845.3	...	86	26	67.6	45.4	56.5	...	57.7	51.4	69	47	1.7	1.68	0.79	8	5,290
Umtali...	896.9	895.2	95	43	76.7	53.3	65.0	67.4	63.8	56.0	63	51	3.9	0.43	0.43	6	3,672
Wankie	929.8	...	102	54	89.8	64.6	77.2	...	73.6	56.9	34	43	0.6	..	0.09	...	2,567
Victoria Falls ...	...	...	103	49	91.3	57.5	74.4	..	69.8	55.7	40	44	0.5	...	0.05	...	2,990

Farming Calendar.

NOVEMBER.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally. where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required. artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour. use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenic of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying lands. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November Spray with arsenate of lead (powder) 1lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to be excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox. Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkins, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult. come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen. the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boilinig water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

TOBACCO.

Continue to sow seed beds, watering. etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery. gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

DECEMBER.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees in their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work

should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken. as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk-borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable green stuff dipped in arsenate of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grass-hoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borers. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by

mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder- 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Officer,

Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning. and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping Big duck breeders often give a fourth meal by lamplight at 10 pm., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

Departmental Bulletins.

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TOBACCO.

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The following pamphlets can be obtained from the Poultry Expert upon application:—

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The Fowl Tick (Argas persicus), by A. Little Poultry Expert.
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Read the Farming Calendar. See page 895.

NOTICE

The Agricultural Journal of S. Rhodesia

is issued by the Department of Agriculture, and can be obtained upon application to the Editor. The Annual Subscription, which must be paid in advance, is 5/-, and payment may be made by any means other than by stamps.

A 10/- note will cover the subscription for two years.

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Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant, Department of Agriculture, Salisbury.

VOL. XXXI.] DECEMBER, 1934. [No. 12.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Publicity.—St. Paul's Churchyard.—The latest exhibition of Southern Rhodesian produce held in the British Trade Review Building, Nos. 1-3, St. Paul's Churchyard, from September 10th to October 6th, was a great success. During the opening ceremony the High Commissioner said that the people of Rhodesia needed no persuasion and no trade agreements to buy from Britain, and their capacity to buy was only measured by the extent to which they were able to sell to those at Home. The shop in which this exhibition took place was ideally situated immediately opposite St. Paul's Cathedral and a very attractive display of tobacco, maize, oranges, cotton, sunflower seeds, ground nuts, minerals, timbers, etc., was arranged. In his report Mr. A. J. Bouchier, the Publicity Officer, states that the publicity accorded by the Press was very good and that the interest evinced by the general public left nothing to be desired.

Publicity.—The British Trade Review.—The Autumn number of "The British Trade Review" devotes 27 pages to Southern Rhodesia, and gives a full account of the Exhibition mentioned above, with a number of excellent illustrations of the various exhibits. On the front page the following appears "Although globe-trotting is each year becoming an increasingly fashionable pastime, Southern Rhodesia is still unknown to all but the most sagacious tourists. Perhaps this is why it has not occurred to the Rhodesian Railways to charge for the excellent sleeping accommodation on their trains. The Victoria Falls, the Zimbabwe Ruins and the Matopo hills are each incomparable in their kind, but they are not the only, or even the greatest, attractions the country has to offer. Rhodesians themselves will almost invariably explain that, apart from the climate, the greatest charm of their country lies in the 'veld.' By this they mean the open wilds which, notwithstanding their infinite variety, have a peculiar and subtle charm unknown to any other part of the world. Over them one can roam in comfort and safety, a few miles or a hundred from the beaten track, amid scenes that have remained unchanged since man first chipped stone axes at the mouth of his strangely decorated caves or speared fish in the palm-clad rivers of the low veld. Sometimes the road, winding amidst sheer granite hills, or over open undulating plains, suddenly brings one to a native kraal where naked picaninnies watch the cattle graze as their forefathers did a thousand years ago. For the sportsman, artist, student of nature, prospector and mere globe-trotter in search of health and happiness, there is nowhere else that offers such charm and variety as Southern Rhodesia."

In addition a series of special articles cover a wide range of subjects and will undoubtedly create considerable interest in the Colony. The Hon. J. W. Downie, High Commissioner, contributed a special article on "Southern Rhodesia and Empire Trade." The Natural Characteristics of the Colony, Agriculture, Mining, Social Life and Tariff Policy are all dealt with at length. It is understood that this is one of a series of Reviews of different parts of the Empire and will be followed in the near future by a similar one on Australia.

Weather Forecasts.—The Meteorologist wishes to draw attention to the change in the system of distribution of weather forecasts from the beginning of next year. Forecasts for agricultural purposes, indicating the weather for the day of issue and the two succeeding days, are made at Salisbury between noon and 1 p.m. on Mondays, Wednesdays and Fridays during the period November to March. Forecasts are now distributed by telegraph to all Departmental Post Offices where they are posted on the notice board and may be obtained by telephone subscribers on payment of a call fee of 3d.

From the end of this year forecasts will be transmitted *free* only to Departmental Post Offices and Postal Agencies where sufficient demand exists. To determine the demand at each office, persons desiring to obtain the forecasts are requested to apply to the Meteorologist, Department of Agriculture, Salisbury, stating:—

1. Name of applicant and farm.
2. Post Office or Agency from which the forecasts will be obtained.
3. Whether it is intended to obtain the forecasts by telephone. (The current charges will apply.)
4. Whether forecasts will be obtained regularly or only at certain periods. If the latter the approximate periods should be stated.

In the event of an insufficient demand for forecasts being recorded at any Post Office, the transmission of forecasts to the office will be discontinued.

Collective applications are invited from Farmers' Associations and subscribers to Party Lines. Such applications should state the names of the farmers who propose to make use of the service.

Rainy Season Compost.—Probably the greatest advance which has yet been made in providing humus in quantity under conditions similar to those of this Colony is reported in Bulletin No. 2 (1934) from the Institute of Plant Industry, Indore, Central India. It is really an adaptation of the Indore compost process which eliminates the carting of water, as the compost is made entirely by the use of the ordinary

rainfall. By this process a rainfall of 15 to 20 inches is sufficient to make a satisfactory compost. The following extracts from the Bulletin explain the method employed.

Successful attempts were made in 1931 to make composts with a few simple operations and rain-water alone, and were followed by large-scale routine manufacture in 1932 and 1933. Appendix I. gives the detailed technique. Farm wastes collected mainly in the dry months are used throughout the year for cattle bedding where possible, and, with dung, urine-earth and ashes, are exposed in heaps to the rains. Three turns provide aeration, and the growing of suitable legumes on the moist heaps between turns hastens rotting. The return to the field of its own wastes is thus literally practicable if the heaps are made on its edge.

This modification is perhaps the greatest achievement of the Indore process, and by its use the quantity of manure produced on a holding can easily be doubled or trebled, according to the quantity of wastes which can be collected. Within four months a compost results containing 0.9 to 1.25 per cent. nitrogen, potash up to 3 per cent., and phosphate about 0.5 per cent. Up to 99.5 per cent. passes a sieve of three meshes per linear inch and 97 per cent. through one of six meshes. The balance of nitrogen and organic matter is shown below.

In comparison with the standard process, decomposition temperatures are lower, fungus growth is sluggish and scanty, yet crumbling is equally rapid, this being due apparently to other organisms. Four inches of rain penetrates about 6 inches into the heap, raising the moisture to 75 per cent., further rain soaks no deeper unless a turn is given. Decomposition accelerates surprisingly following timely turns; with 5 inches of rain before the first turn and 10 before the second crumbling is far advanced. This brings areas of low rainfall within range, and indeed in the standard process the water required, being intimately incorporated and conserved, is equivalent to only about 16 inches of rain over the area of the pit. Effective rainfall of less than 20 inches (controlled by covering the heaps) gave satisfactory results in 1933. Better use of low rainfall would follow initial exposure in shallow heaps, making two into one at the first turn.

The speed of fermentation determines water requirement. Uniform, rapid soaking, frequent aeration by turning, and growing legumes on the heaps between turns, all promote quick decay and water economy.

In rain-watered heaps with excess of cotton and sorghum stalks and sugar-cane trash, decomposition is slow, owing both to low nitrogen content and to defective physical texture with associated uneven aeration and moisture. In 1932 the leguminous *sann* hemp (*Crotalaria juncea*) was grown on such heaps to add nitrogen by fixation. The plants grew only a foot high, but developed a dense mat of roots crowded with nodules. After turning, the heaps decomposed to excellent compost as rapidly as those of mixed wastes.

Further tests confirmed these observations, which showed the practicability of (1) intensive nitrogen fixation in routine composting and (2) easy decomposition of refractory wastes poor nitrogen, like cane trash, without admixture of better material. *Sann* gave better nodule-development than other legumes tried and was best sown after the first turn. Evidently the quickened decomposition was due, at least partly, to the nitrogen fixed by the *sann* hemp.

An old problem with sugar-cane growers is the disposal of trash—usually burnt, with complete loss of valuable organic matter. This material, difficult to rot because of its low nitrogen content (about 0.3 per cent.) and its tendency to pack densely, is now yielding to suitable modifications in treatment, including the growth of *sann* hemp as a nitrogen fixer. The technique is being adjusted to suit the needs of both large and small growers.

MATERIALS.—(1) *Mixed farm wastes* of all sorts—weeds, stalks of cotton, pigeon-pea and sesamum, any inedible or unwanted threshed straw and chaff, sugar-cane trash, stumps of sorghum, millets, maize and sugar-cane and uneaten fodder residues. Hard materials need cracking; spreading them on a road or cattle track does this, even if on soft land.

(2) *Dung* of cattle, horses, sheep, goats or camels—about 1½ cubic feet at least per cart load (35 cubic feet) of wastes. Larger quantities may be used safely, but excess is uneconomical.

(3) Ordinary *field soil*, preferably taken from where cattle usually stand, whether in a shed or outside—having absorbed urine it is rich in nitrogen. About 3 cubic feet per cart load is enough.

(4) Wood or vegetable *ashes*, if available, should be added to enrich the compost in potash and to neutralise acids produced in rotting. One cubic foot per four cart loads is a suitable quantity.

METHOD.—*Making the Heaps.*—Mixed wastes (say a cubic yard per bullock) are spread where the cattle usually stand and are renewed daily or every few days. If cattle dung is required for fuel, as in India, up to three-quarters of it can be reserved at this stage—the remainder will be enough for the compost and should be scattered over the bedding before its removal to a convenient well-drained site, where it is made into a heap 8 feet broad, 3 feet high and of suitable length. It should be built to full height in three days to allow the dung to dry rapidly, unless it is actually rainy weather. The necessary soil and ash may either be thrown on top or added in the cattle shed.

It is not essential to use the wastes as bedding, but a mixture of several kinds is very desirable (there are often difficulties in composting single wastes), and, of course, the soil and dung must be added. If urine-soaked earth is not readily available ordinary soil may be used, with more dung.

First Turn.—When rain has penetrated the heap to 6 or 9 inches depth it is turned with a fork to make a fresh heap at one side or one end of the original heap. The object of this is to mix the wet and dry material; further rain then soaks in better.

Second Turn.—After about a month the heap is turned back to its former position.

Third Turn.—About a month later the last turn is given.

Turning distributes moisture and ensures aeration; it should be done on a rainy or cloudy day to check evaporation.

The time-table suits a normal rainy season in Central India; if rain is deficient turning should be delayed, and if

the heap is not well rotted a fourth turn should be given. The compost is generally ready to use in four months; three cart loads of wastes will make more than a load of compost.

In areas where rainfall is apt to be uncertain, the process is more rapid if a leguminous crop (*sann* hemp is found most suitable at Indore) is sown on the top of the heaps after the first turn. Whatever growth it makes is mixed with the rest of the heap at the second turn and promotes rotting. If in a district of low rainfall the heap at any stage is obviously too dry for rotting, it may be spread in a shallow layer when rain is falling and, when soaked, built up in to a heap again.

St. Dunstan's in South Africa.—Functions of this Committee.—The Administrative Committee of the St. Dunstan's After Care Fund for South African Blinded Soldiers is responsible for the care of the 26 South African and Rhodesian blinded soldiers, who were re-educated and trained at St. Dunstan's, London, their wives and families, and for the three widows and orphans of blinded soldiers, numbering in all 94. They are responsible also for the collection of monies for the Headquarters and South African Funds, appeals for these being issued from their Headquarters in Cape Town and through their local Collecting Committees, which have been set up in all the big towns and a number of the smaller ones in the Union and Rhodesia. From the balance sheet and accounts it is evident that benefits include the general maintenance of the properties of blinded soldiers, assistance with the payment of rates, taxes and insurances, including life insurance premiums, special allowances to men unfit to work and to all in time of special need; the supply and renewal of wireless sets and an annual holiday allowance; grants for relief of financial and family difficulties, local medical and dental treatment, artificial eyes, and for renewal and repair of Braille watches and special appliances used by the blind. Benefits also include special help to the handicraftsmen such as the payment of dock dues and charges in connection with the importation of raw materials, which are supplied by London Headquarters at a special price, railage on finished

goods and other charges incidental to sales of finished goods. The Committee keeps in close touch with the men by correspondence and visits and through the local Committees.

Employment for South African Beneficiaries.—All the South African blinded soldiers who are fit enough to do so, work and work hard. The masseurs made splendid progress and the handicraftsmen last year made and sold more articles than ever before. By the courtesy and generosity of the Agricultural Societies, stalls are arranged at almost all the big shows, with excellent results, these being organised and run by the members of the St. Dunstan's Collecting Committees in the various centres in the Union and Rhodesia.

Past Support and Future Needs.—The generosity of the South African public—as of the British—remains at a high level, so that the Committee were able to meet their liabilities and the claims of the beneficiaries. Since the actuarial report of 1929 was made, several new beneficiaries have been added to the South African Fund. The report is, therefore, being investigated in order to ascertain just how much more money is required in the capital fund, so that, by using interest and capital, a reasonable standard of benefits is assured to the men for the rest of their lives. It is realised that the fund is several thousand pounds short at present—it has been impossible to add to this during the years of depression—but when the amount required is accumulated, appeals to the public will cease. Until that moment, it is hoped that supporters will continue to subscribe to their utmost, realising that the work of St. Dunstan's must go on "For the Duration" of the blinded men's lives.

A CORRECTION.

In the November issue on p. 794 in the table of results of Series 3 Experiment, for 1930-31 read 1931-32; for 1931-32 read 1932-33; and for 1932-33 read 1933-34 in the headings to the first, second and third columns of the table.

The Use of Galvanised Iron
IN THE MAKING OF SOME APPLIANCES FOR POULTRY KEEPING.

By G. H. Cooper, Assistant Poultry Officer,
Matopo School of Agriculture and Experiment Station.

In very few poultry keepers' yards is there to be found a good selection of appliances, and it is to be hoped that some improvement may be made in this respect that these few notes on the construction of some simple appliances are penned.

Material.—Timber of any sort has been found to be most unsuitable for poultry appliances in this country, because of the havoc wreaked by white ants and the fact that in the dry atmosphere all wood shrinks and nails drop out in time.

Galvanised iron should be used wherever possible, for it is not effected by either of the aforementioned and it is actually cheaper per square foot than most timber; further, it is hygienic and is more or less everlasting. It makes a neater job. The following appliances have been made and tested out at the Matopo School of Agriculture and have given every satisfaction.

Feeder for Mature Birds (Figs. 1 and 3).—Many poultry keepers are changing their ideas about the usefulness of a large hopper-feeder, because these so-called self-feeding hoppers rarely do self-feed in practice, and further, it is preferable to place before the birds daily a fresh lot of mash. In self-feeding hoppers the birds tend to pick out certain feeds from the mash and leave the rest, which may remain before them some considerable time. Also, the amount consumed can be better regulated in a feeder without a hopper, and rats and wastage are less troublesome. The feeder described here is for half grown pullets or mature birds on range and will serve for 50 birds. If it is to be used in a laying house the top protection of corrugated iron is not necessary, the legs being cut off level with the alighting board. If there are more than 50 birds in a laying house extra feeders can be put in

according to the number of birds. These feeders are portable. If cocks with large combs have to use this type of feeder it will be necessary to raise the roller above the trough an inch more in order not to damage the comb.

Construction.—Four troughs without ends can be made from a sheet of flat galvanised iron 6 ft. x 3 ft. A strip of iron 18 inches x 3 feet is cut from a sheet of iron, being careful to cut at right angles. Each edge along the threefoot sides is bent over $\frac{1}{4}$ inch or less to make a round edge. Three inches from each edge so rounded the iron is bent at right angles lengthways. Again six inches from each of the right angle bends the iron is again bent at right angles lengthwise. This gives a V-shaped trough 3 feet long 6 inches deep with 3 inches lips bent inwards.

The ends are cut corresponding to the shape of the end of the trough and soldered in. Wooden ends may be used, but are not recommended.

Before soldering in the ends pieces of firm hoop iron 3 inches long, one with an $\frac{1}{8}$ inch hole near the top and one with a slot leading to an $\frac{1}{8}$ inch hole are rivetted one to each end in the middle and allowed to project over the top end, so that the holes are $1\frac{1}{2}$ inches from the top of the end.

A piece of wood 1 inch x 1 inch x 3 feet is taken, a $2\frac{1}{2}$ inch nail cut in half and each half hammered into an end of the wood in the middle, leaving $\frac{1}{2}$ inch projecting. This forms the roller and is placed in position by pushing the nail without head through the hole in the hoop iron at one end of the trough and the other into the hole at the other end by means of the slot. This roller will now revolve on being touched and so serve the purpose of keeping the birds from getting into the feeder or from perching on the roller and soiling the feed. This completes the trough section, which is placed in a stand as shown in the photograph.

The stand can be conveniently made from timber to be had from a motor car case or flooring board.

Take four pieces of timber each 2 inch x 2 inch x 2 feet 9 inch to form the legs; these are held apart lengthwise by cross pieces 3 feet x 3 inch x $\frac{7}{8}$ inch nailed at right angles, the top of cross pieces being 18 inches from ground level.

Two pieces of timber 16 inch x 6 inch x $\frac{7}{8}$ inch are nailed to the inside of the leg pieces at the same height as the cross pieces. These serve to keep the legs apart across the structure and to hold the trough. Before fixing these last planks in position a right angle notch is sawn out of the middle of each, the point of the V being half way, or 3 inches down, the plank.

Two pieces of timber 3 feet 3 inch x $\frac{7}{8}$ inch are next nailed to the last-mentioned pieces, one on each side, between the legs to serve as alighting boards for the birds to stand upon when feeding. Again two pieces 16 inch x 6 inch x $\frac{7}{8}$ inch are taken and sawn to form a sloping top, being 3 inches at the ends and 6 inches in the centre. One piece is nailed to the projecting legs above the trough at each end. Over these is bent and attached with screws a piece of corrugated iron 3 feet x 2 feet. The feeder is now complete and may be used for mash or grain feeding.

When these feeders are used in a laying house it is advisable to have a storage bin containing feed, either in the house or in close proximity. A rat-proof bin made from a 44 gallon oil drum is ideal. A sloping lid of galvanised iron to prevent birds perching can be constructed and the drum placed in the house. These drums are given away if paraffin is purchased in bulk.

Feed Troughs for Chickens (Fig. 4).—For baby chickens until about three weeks of age. A piece of flat galvanised iron is cut 3 feet x 7 inches wide. Each 3 feet edge is bent over $\frac{1}{4}$ inch to form a smooth edge. Again each 3 feet edge is bent at right angles $\frac{1}{4}$ inch from the edge. One and one-half inches from each of these right angle bends the iron is again bent at right angles. This gives a 3 feet rectangular trough 3 inches wide $1\frac{1}{2}$ inches deep with a $\frac{1}{4}$ inch lip turned inwards along each side.

Two ends of galvanised iron 3 inch x $1\frac{1}{2}$ inch are cut and soldered into each end. A piece of plain galvanised wire No. 10 is taken 3 feet 1 inch in length and $\frac{1}{2}$ inch turned at right angles at each end. This wire is placed down the centre of the trough and the bent over ends soldered to the ends of the trough. Five pieces of similar wire 5 inches in length are taken and in the centre are lopped around the wire running lengthwise down the trough. The five short wires are now

soldered on each side of the trough at regular intervals of 6 inches. These are at right angles to the long wire and keep it firmly in place along the centre of the trough. The wires prevent chickens from getting into the trough and scratching out the mash. For chickens from three weeks to three months of age similar troughs can be made of slightly larger dimensions having an opening each side of the centre wire of not more than 2 inches. These comprise all the feeding utensils that will be required on the poultry farm.

Drinking Vessels (Fig. 5).—For baby chickens until two to three weeks of age. The old reversed bottle type of drinking fountain is hard to beat if the stand is made of galvanised iron and the bottle used is of a clear glass so that it can easily be seen if it is clean.

For the bottle use a square-sided Johnnie Walker whisky bottle. These are always of clear glass and the same size, as well as being easily procurable.

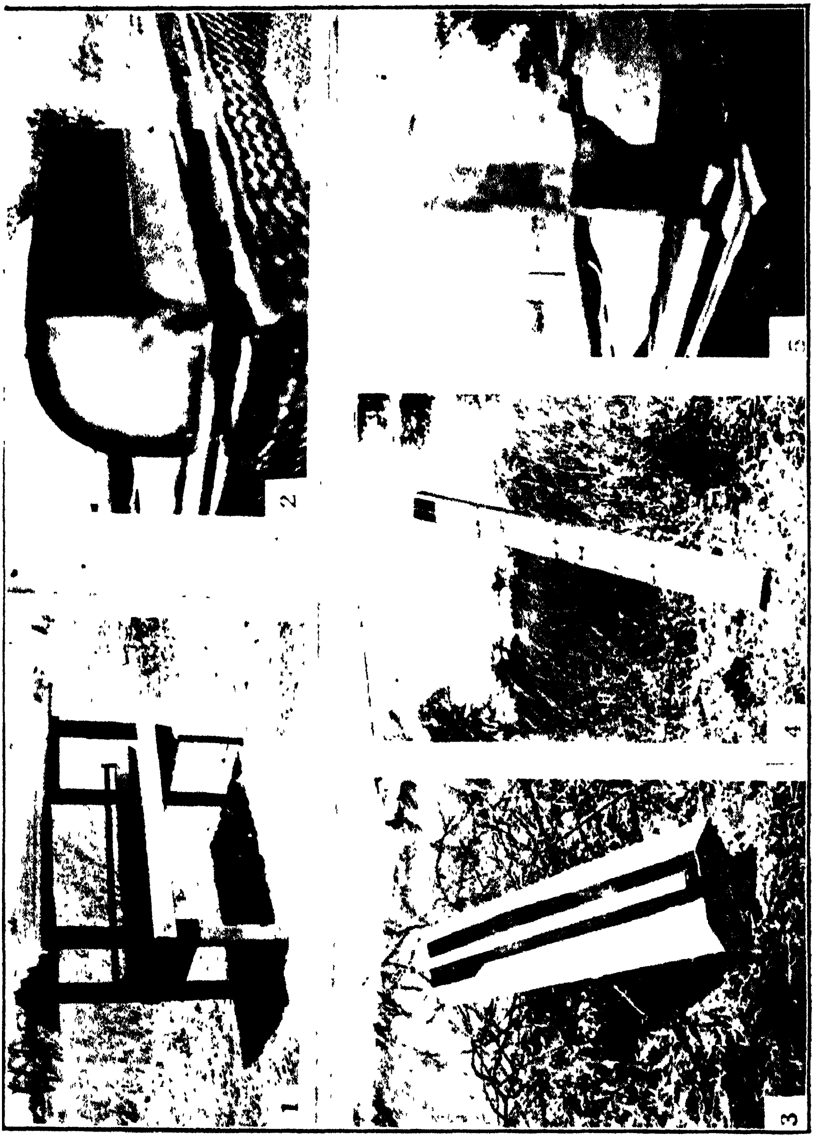
To make the stand and drinking trough all in one is essential .

Take a piece of flat galvanised iron 1 foot x 4$\frac{3}{8}$ inch. Turn the two edges along the long sides over $\frac{1}{4}$ inch as before to make a smooth edge. Again bend each edge at right angles $\frac{1}{2}$ inch from the edge. This is to form the upright support for the bottle. Cut another piece of iron 5 inch x 3 inch to form the bottom of the drinking trough and round off two of the points at one end.

Take a piece of iron 12 inches long and 1$\frac{1}{2}$ inches deep, bend over one edge $\frac{1}{4}$ inch and flatten. Bend this piece of iron round the piece of 5 inch x 3 inch to form a receptacle, having the turned edge upwards. These are then held securely and soldered together.

The upright support with the $\frac{1}{2}$ inch flanges inwards is then soldered at one end to the three-sided receptacle thus formed, making a water-tight receptacle with the upright support at one end.

A piece of iron 8 inch x 1$\frac{1}{2}$ inch is soldered in a loop to the upright support on the inside of the $\frac{1}{2}$ inch flanges half way up and bent to take the shape of the bottle. This is the support for the bottle to prevent it from falling out. The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bottle is placed in position by pushing it mouth first down the upright support through the loop of iron so that the orifice is just below the top edge of the receptacle. Measure the distance between the orifice of the bottle and the bottom of the water receptacle—it will be about 1 inch. Immediately below the orifice of the bottle solder a piece of iron $\frac{1}{4}$ inch wide bent like an arch with feet. This strip of iron prevents the bottle from slipping too far into the receptacle. The bottle is filled with water and quickly placed in a position as described previously. The water will pour out into the receptacle until the level of the orifice is reached when it will be checked. As the water is consumed the level will drop and water will flow from the bottle. Thus the receptacle is always full so long as there is water in the bottle.

It is important that the orifice of the bottle should be just below the rim of the container and that the vessel should be level otherwise the water will flow continually.

The fountain may be used for milk also if it is not too thick.

Drinking Vessel for Larger Chickens (Fig. 2).—Cut a piece of galvanised iron 16 inch x 12 inch. Bend over each edge along the 12 inch sides $\frac{1}{4}$ inch to make a smooth edge.

Two inches from one of these edges bend the iron at right angles. Again five inches from the last bent make another right angle bend. With the 5 inch side downwards on the bench bend the longer upright side over in a curve till the edge is immediately above the edge of the shorter upright side, and 3 inches from it. Two ends 5 inches wide and cut to fit the curve are soldered in and the vessel is complete. The water or milk is protected from contamination by birds and fiom heating by the sun.

Larger vessels may be made for mature birds on a similar pattern having a deeper water receptacle up to six inches. If these appliances are made as suggested and well cared for they will be everlasting as well as being economical and hygienic.

These appliances are easily constructed, and if the poultry farmer will study the requirements of his flock he will probably be able to improve on them himself.

The Destruction and Control of Locust Hoppers.

By R. W. JACK, Chief Entomologist.

The following includes a brief account of various methods which may be utilised for the destruction and control of locust hoppers and directions for the employment of Government locust poison in the 1934-35 campaign. It is intended for the information of farmers and Government officials concerned in locust control.

I. MECHANICAL METHODS.

1. **Destruction of Eggs.**—This is practised in certain areas where there is a comparatively dense and concentrated population or a large supply of labour is available, as for instance, on sugar estates. Natives employed for the purpose are paid by results, so much per given weight of eggs, say, 1d.—2d. per lb., dependent upon the nature of the soil.

This measure is useful if eggs are laid in the midst of a cultivated crop, or perhaps generally in a locality of intensive cultivation.

In cultivated unplanted lands, repeated ploughing and discing of egg deposits is likely to be beneficial, although complete control cannot be anticipated from this measure.

2. **Mechanical Killing of Hoppers.**—The simplest of these methods is to beat the hoppers down with branches, sacks, wire flails, broad strips of leather on short sticks, etc. Such measures are useful in emergency or in special circumstances, as for instance when hoppers hatch out actually in the midst of a crop.

The use of animal drawn hopper crushers, such as rollers, chain harrows, brushwood drags, etc., is out of date and more or less discredited, as it mostly scatters the hoppers and only destroys a small proportion. The same may be said of trampling with oxen and sheep.

3. **Trenches and Barriers.**—Trenches and other forms of barriers can be used to (1) prevent hoppers getting into a crop and (2) to destroy hopper bands.

Trenches need to have straight vertical sides or to be undercut. They are usually made about 2 feet square in section, and every 10 yards or less deeper holes are sunk. The hoppers tend to collect in these holes and are then readily destroyed.

Trenches have been used during the present swarm cycle in Southern Rhodesia to protect native lands. Their construction, of course, involves a great amount of labour, and they may need a considerable amount of attention to keep in repair if heavy rains occur.

Barriers in the past have been constructed of light fabric on a light wooden framework, but galvanised iron has been used more recently. Galvanised iron in this Colony is supplied in sheets 6 feet long by 3 feet wide. Half the width, namely, 18 inches, is regarded as a sufficient height for a barrier, so that one sheet will provide rather less than 12 feet of barrier, allowing for overlap. Various methods are used to connect the sheets, but the simplest method appears to be a simple overlap held in position by a peg on each side, the top of the inside peg being well below the top of the barrier. It is estimated that this form of barrier at retail prices in Southern Rhodesa would cost about £8 10s. 0d. per 100 yards for material alone, wooden pegs being used.

Needless to say the grass needs to be cut short, or the ground to be cleared, on the side of the barrier from which the hoppers are expected to come.

For catching hoppers at a barrier pits are sunk at intervals close to the barrier on the "hopper" side, and may be overlapped by pieces of galvanised iron on each side as illustrated in Fig. 1.

When utilised primarily as traps, the barriers are erected at right angles to the line of advance of a hopper band and are made long enough to embrace the whole "front" of the insects, the ends being commonly curved in that direction.

Another method, utilising enclosures instead of pits, is illustrated in Fig. 2.

The employment of barriers to destroy locust hoppers is not feasible under all conditions and is very expensive in labour and transport. Consequently, this method is not adopted for general use in an extensive campaign in a country like Southern Rhodesia. Barriers have been used successfully for trapping hoppers in the Natal sugar belt, but have only been tried on an experimental scale in Southern Rhodesia, and it cannot be said that the results were conspicuously successful. Good results against the Red Locust are, however, reported from Tanganyika.

4. **Fire.**—Hopper bands can sometimes be destroyed by burning the grass, and it is worth while to preserve grass for this purpose. It should be noted that large hoppers, especially, are frequently able to escape from the path of a summer grass fire, and it is therefore necessary to create and maintain a complete circle of fire round the hoppers. It may be added that there are some indications that the Red Locust may lay eggs more freely in newly-burned ground than in the long grass, and this may profitably be borne in mind.

The use of flame throwers is now more or less generally discredited as being exceedingly expensive, and fraught with danger to the operators. It is apparently quite unsuited to a general campaign in this Colony.

II. CHEMICAL METHODS.

1. **Contact Insecticides.**—Various substances are known which will kill locust hoppers on contact, at least if the hoppers are thoroughly wetted. These include various mineral oils, paraffin and allied substances, soap solution, paraffin emulsion (soap and paraffin), as well as apparently some other substances.

Naturally all Governments are anxious to utilise something which is less poisonous than arsenic for locust destruction, but the employment of any known effective purely contact insecticides on a large scale for this purpose has so far been ruled out by the cost.

These substances are even more expensive in use than their primary cost indicates, because they mostly have to be used liberally, every hopper needing to be thoroughly wetted to be killed. This is not the case with arsenite of soda solution.

Soap solution (1 lb. in 3 gallons of water) appears to kill at least very young Red Locust hoppers if they are thoroughly sprayed, and may possibly have a sphere of usefulness in the case of hoppers hatching out in the midst of a crop of maize for instance. The soap needs to be cut into thin slices and thoroughly dissolved in hot water.

2. **Internal Poisons**—The only internal poisons used extensively against locusts consist of one or other of the compounds of arsenic, but arsenite of soda is by far the most widely employed.

Whilst this compound is, of course, an internal poison, it is also a contact poison, and when applied as a spray is primarily used as a contact poison. It has a dual action, however, even when used as a spray, and the outstanding effectiveness of spraying is largely due to this fact.

Baits.—In certain countries arsenic is used purely as a stomach poison in the form of poisoned bait, but such baits have not proved reliable under all conditions against Red Locust hoppers, being practically ineffective under humid conditions, although more effective in dry weather. As hopper campaigns are carried out in the wet season in this Colony, this is a very serious obstacle to the general adoption of baits. There are also serious administrative difficulties which might, however, be overcome if bait was more reliable against the Red Locust hoppers.

Baiting against this species of locust is rather an experimental undertaking. The following has proved reasonably effective under certain conditions:—Dissolve 3 ozs. of arsenic of soda powder in 2½ gallons water, and mix with ground maize cores until the latter are thoroughly wet. The quantity of dry maize cores needed for this amount of liquid will be about a petrol tin full. Strew amongst the hoppers or in front of a moving band. Thirty pounds per acre is recommended in Kenya for a somewhat similar bait. If dry maize cores are not available, maize meal, bran, sawdust or

other carrier may be used, but these should be only moistened, not saturated, with the solution. It is thought that such baits attract the Red Locust hoppers mainly because they are wet, but there is some evidence that Brown Locust hoppers are definitely attracted by arsenite of soda.

APPLICATION OF POISON.

Spraying.—Arsenite of soda solution, if brought into contact with a locust, tends to be absorbed, and to bring about its death. This is the primary object in spraying, but the insects will die if they eat sprayed vegetation, and they also probably drink the liquid, at least in dry weather.

Spraying has been used more extensiveyly, at least in South Africa, than any other method. Formerly it was considered necessary to add sugar to the solution, but this has now been generally abandoned, and the plain solution is used.

For the purpose of the 1934/35 campaign, arsenite of soda for spraying has been procured in 20 lb. drums with a yellow label. The powder itself is greyish in colour.

One Government measure, containing approximately 3½ ozs. of arsenite of soda, must be dissolved in a petrol tin (4 gallons) of water by thorough stirring.

On no account must this strength be exceeded. It has been shown to be fully efficacious against all stages of the Red Locust and use of greater strength is quite unnecessary, wasteful of poison and increases the danger of stock poisoning.

The tendency to use greater strength than laid down with a view to obtaining a quick kill is one of the greatest difficulties encountered both in the Colony and elsewhere, and a serious view is taken of the matter. Locusts sprayed at the correct strength may not die within several days and should mostly die between 24-48 hours after spraying. If large numbers die within a few hours, it is an indication that the poison had been used in too strong a solution.

The solution is to be sprayed over and around resting bands and in front of moving bands. In the heat of the day the hoppers may be too active for effective spraying. The best

work is usually done in the morning, late afternoon and evening. On dull days effective work is usually possible throughout the day.

The spray needs to be applied very lightly.—There is no need to drench the hoppers or the herbage. The solution is commonly applied far too heavily, a proceeding which has led to many cases of stock poisoning. The spray needs only to be passed with a slow movement once over each portion of a hopper band. Continuous spraying on one spot is a common habit of native operators and is to be guarded against.

Keep the pump in proper working order by cleaning it, tightening glands, and repacking it when necessary. A pump in proper order should throw a spray comparable with that illustrated in the accompanying photographs. The nozzle lever should be adjusted to throw a fine spray on most occasions, but may be opened to secure distance when necessary, provided that the stream breaks up well, as in the photograph.

When repacking pumps use plenty of grease.

Dusting.—The method of dusting hopper swarms by shaking out dry arsenite of soda powder through small holes in the containers has never been adopted to a serious extent in Southern Rhodesia, and has now been abandoned elsewhere. It is a dangerous operation.

A new machine for dusting locust hoppers which appears to be of sufficiently durable construction, has now been developed in the Union of South Africa, and a number of these have been purchased for use during the coming campaign. The intention is, however, to confine their use to Government operators, at least until considerable experience has been gained. It is not quite certain how useful they will prove under Southern Rhodesian conditions, although the experience in the Union has been very satisfactory. They are likely to be particularly applicable to areas where water difficulties exist.

The coarser grade of arsenite of soda, grey in colour, and contained in 20 lb. drums with yellow labels, supplied for spraying purposes, *is not suitable for dry dusting.* A finer

grade is manufactured for this purpose. This is yellow in colour and is contained in 30 lb. drums with a white label.

Dry dusting may be a dangerous operation in careless hands. Spraying is regarded as less dangerous, although the free use of such a potent poison as arsenic calls for great care in any case.

DANGER.

Arsenite of soda is not only highly poisonous to insects, but also to all forms of animal life, including Man. This constitutes the greatest drawback to its use, and all Governments concerned with suppression of locust outbreaks would welcome discovery of a non-poisonous or less poisonous substitute of equal efficacy and not too much more expensive, Unfortunately this is lacking at present, although research work is being prosecuted in this connection.

It is perhaps not generally realised that, before the use of arsenic, locust control in the two countries which suffer most from these pests, namely, Africa and Russia, was in a thoroughly unsatisfactory position and that in South Africa and Russia at least, the use of arsenic has vastly improved the position.

In using arsenite of soda there are two points to be remembered, namely:—

(1) That the compound is exceedingly poisonous, and

(2) That it has a serious caustic effect on the skin.

Commonsense will dictate the procedure in the circumstances, but the following rules may be laid down, namely:—

(1) The poisonous nature of the compound must be impressed upon all native and other employees.

(2) Locust poison, even in unbroken drums, should be kept under lock and key in store and under adequate supervision in the field.

(3) Operators should avoid contact with the poison as much as possible, and must wash frequently, especially before meals. This is particularly to be impressed upon native operators.

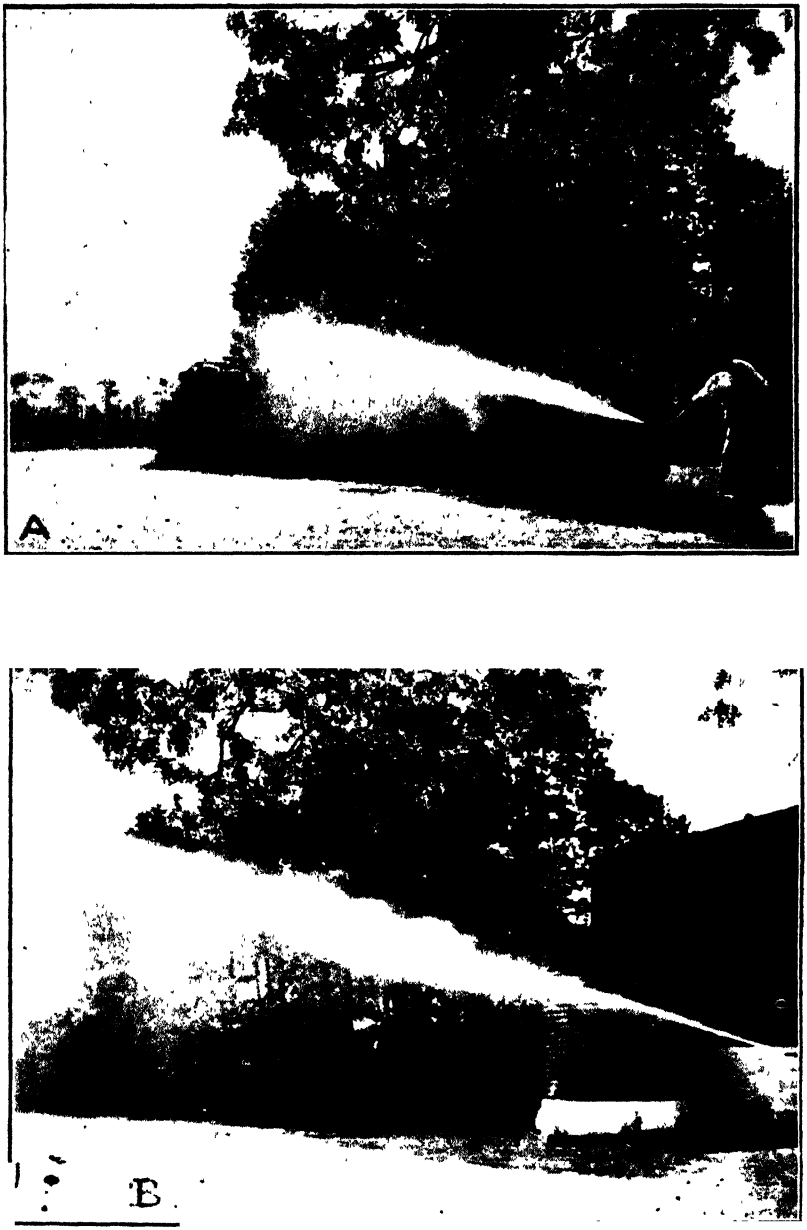


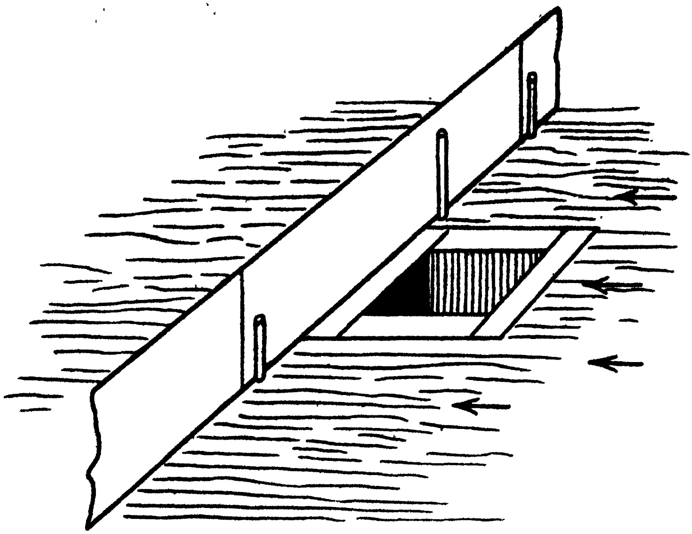
PLATE I.

Spray obtained with good pressure, using standard locust pump and nozzle. The same equipment was used for both photographs.

A.—Using nozzle partly open.

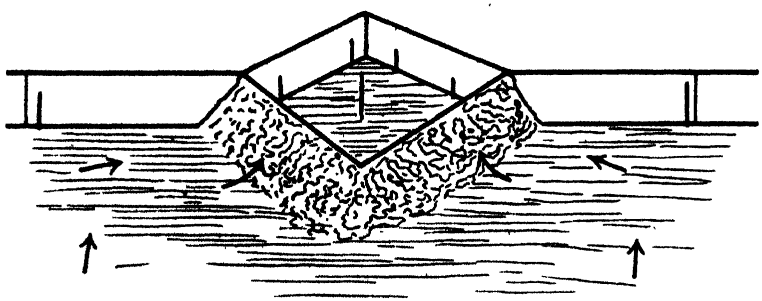
B.—Using nozzle fully open.

(Photos by J. C. Hopkins.



Barrier with pit (partly after Bücher).

FIG. 1.



Barrier with enclosure or kraal (largely after Official Instructions Mexico).

FIG. 2.

(4) Free drinking of water is a safeguard against arsenical poisoning.

(5) Grease rubbed on hands and legs is a safeguard against burning of the skin, which, if care is not exercised, may prove serious. All Government gangs are supplied with grease for this purpose.

(6) Prepare the spraying solution according to directions and spray (or dust) *lightly*.

(7) Keep livestock away from sprayed or dusted veld until a good shower of rain has fallen.

(8) Burning sprayed patches of grass also removes the danger when this is possible and necessary.

(9) Arsenite of soda powder spilled on the soil constitutes a very serious danger, also soil saturated with strong solution. Salt hungry animals will lick up the arsenite or soil like salt, and a number of accidents have been brought about in this way. If the arsenite is spilled it must be collected and buried effectively, but spilling is to be carefully guarded against. Probably an abundant ration of salt to livestock would materially lessen the attractiveness of the poison.

(10) The greatest care is necessary in regard to drums, tins, etc., which have contained the poison. Natives will undoubtedly tend to appropriate them for cooking purposes. *All such containers must be carefully accounted for.* They should be stamped flat and buried in the soil. Burning in an ordinary fire is stated not to remove the danger. The careless leaving on the veld of tins still containing arsenite has been the cause of several accidents to cattle. Such tins may remain dangerous for months, and carelessness in their disposal is inexcusable.

ANTIDOTES FOR ARSENICAL POISONING.

In the case of human beings that get poisoned from arsenic, an emetic should be given at once and medical assistance summoned immediately. In the meantime, as soon

as the stomach has been emptied by vomiting, iron or magnesia preparations may be given if available, followed by liberal quantities of milk or water.

Collapse should be treated by the ordinary measures, using warmth and stimulants.

Cattle poisoned with arsenic should be dosed with oil or equal parts of oil and lime water and should be kept warm.

A useful emergency remedy in arsenical poisoning is freshly precipitated iron hydrate, which may be prepared by adding magnesia to a solution of iron sulphate. Magnesia alone, shaken up with water, may also be given and is claimed to be efficacious in preventing gastric inflammation.

Fattening Bullocks on the Bulawayo Municipal Farm.

We are indebted to the Town Clerk, Bulawayo, for the following interesting report by Mr. R. Dickson, Farm Manager of the Bulawayo Municipal Farm.

On the 1st April twenty good class range steers were purchased; they averaged three years, and their total live weight was 20,780 lbs.

They were grazed on the farm paddocks on fair grass until 15th May, and during the following fifteen days they were allowed to roam on reaped mealie lands, and at the same time were fed on 500 lbs. of green crops during the nights.

During June they were driven into a small paddock and were fed daily upon 200 lbs. of mealie-stover and 500 lbs. of green crops. From 1st July until the end of the feeding period—10th September—they received daily 200 lbs. of mealie-stover, 400 lbs. of green crops, 165 lbs. mealie meal (fed dry), and 50 lbs. of velvet bean hay.

Thus 25½ tons of green crops, 10 tons of mealie-stover, 1¾ tons of velvet beans, 60 bags of mealies, with the grazing, as stated above, brought the weight of these twenty steers on 10th September, to 25,160 lbs. live weight—an increase of 4,380 lbs. When slaughtered they were classified as primes which were well finished.

The paddock was four acres in extent, having a temporary wind-break, a few scattered feeding troughs, together with one of water. These animals ran free, so that the shy beasts were handicapped to some extent during feeding time, as all were horned cattle.

The mealie-stover was practically leafless owing to the locusts. What is termed green crops was comprised of late grass, weeds and lucerne, all of which were found on the lucerne lands during the months of May and June—prior to

establishing the cleaned winter growth. The green crop fed during July and August was of better quality green oats, barley wheat and lucerne.

These animals showed a drop in condition at the end of June, but signs of a rapid development were detected immediately the improved rations began in July. At least half were prime three weeks prior to the day of sale.

In my opinion one result of the experiment is that the extended period of green feeding from the green veld, by irrigation crops, assisted greatly in the ready response to the concentrated rations.

The original idea was to use ripe oats as a concentrate, but the oat crop did not mature in time, and the rebate on maize meal for feeding export cattle left no room for hesitation.

Although 100 per cent. of the animals purchased were still in their growing stage, they were fed and sold together on the same date, and some did better than others. At least three made very little progress in comparison—being shy of the boarding-house conditions—the weak giving way to the strong. Therefore, dehorned stock for feeding purposes have a great advantage.

Ignoring the cost of the water supply for irrigation the expenses, including drinking water, native attendance and a fair price for the crops grown on the farm, the cost to fatten in round figures is 50s. per head. This cost includes the maize at 6s. per bag.

SOUTHERN RHODESIA

Official Egg Laying Test, 1935.

The next test will commence March 1st, 1935. Entries close 18th January. Full particulars, rules and entry forms can be obtained on application to the Chief Poultry Officer, Department of Agriculture, Salisbury. Single pen accommodation is provided. Intending competitors are requested to make early application.

A New Type of Tobacco Furnace.

By B. G. Gundry, A.I.Mech.E.

The tobacco furnace herein described has been evolved by the writer in an effort to meet the need for an economical furnace which is both cheap and easy to build. As will be seen from the accompanying illustration the furnace consists of a rectangular structure built in 9 inch brickwork, the internal dimensions of which are approximately 7 feet long by 1 foot 6 inches wide. The side walls are corbelled or stepped out at the top until they meet to form the roof. At the front end an opening 18 inches square is left, through which the furnace is stoked.

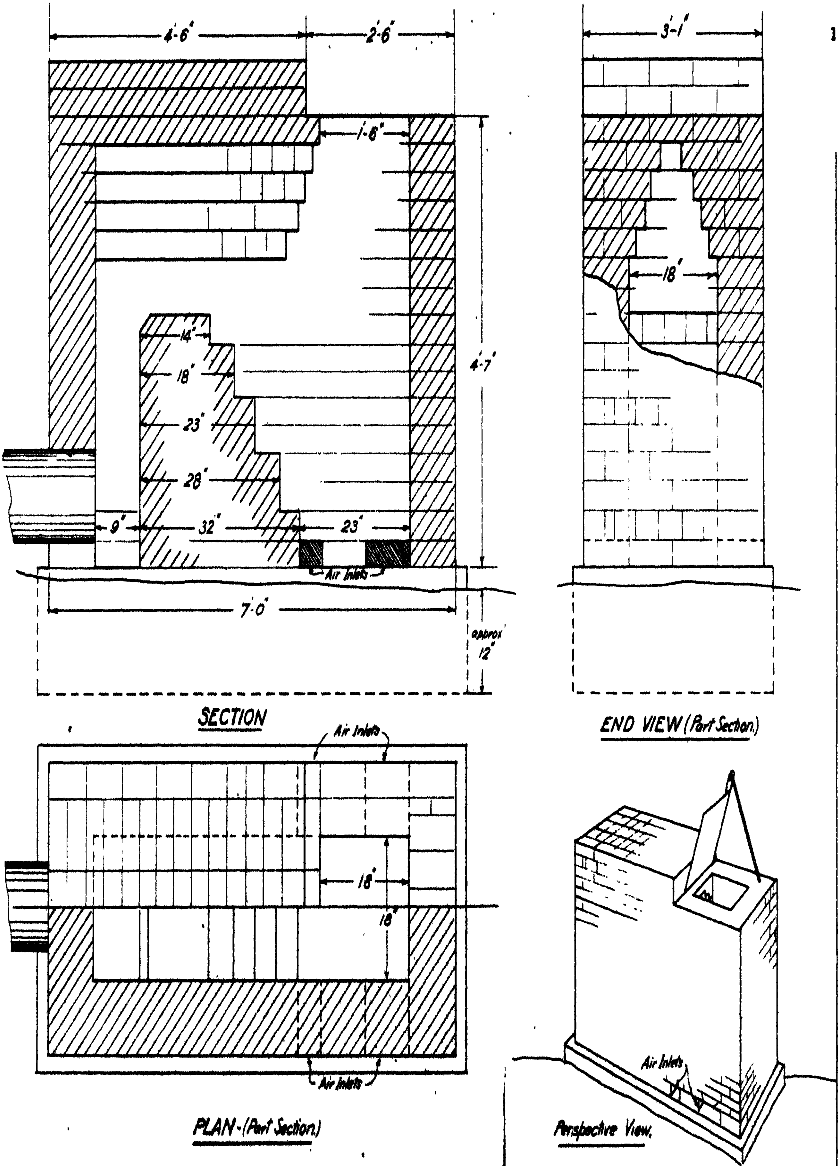
The baffle wall is stepped back from the front towards the back of the furnace to form an inclined hearth on which the fuel lies. Two air inlets are left in each side wall and the amount of air admitted to the fire is controlled by inserting loose bricks in these holes, and it is somewhat astonishing to find what a small amount of air is required to maintain a large fire.

The foundations should extend at least 6 inches below ground level and may be laid in dagga, although lime mortar will, of course, render them more permanent. The height of the foundations (or hearth level) should normally be somewhat below the floor level of the barn but, in any case, the outlet flue from the furnace should be below the level of the top of the baffle wall. The back wall of the furnace may be either touching the barn wall or a space of 12 inches or more may be left between, in which case the flue pipe between the furnace and the barn should be built in with bricks and dagga to conserve heat.

The walls of the furnace should be built as far as possible in "Colonial" bond, *i.e.*, 3 courses of stretchers and one course of headers, laid in dagga. The side walls of the furnace will probably develop cracks in the outer courses owing to the greater expansion of the inner courses. These cracks can be filled in with dagga as they appear, but in order to prevent them becoming serious and to strengthen the structure generally it is advisable to build in two strands of barbed wire or hoop iron all round the walls between each two courses of brickwork.

In the experimental furnace the stoke hole was covered with a piece of iron plate 1-16th inch thick, fitted with a supporting arm, as will be seen in the small perspective sketch, in which the cover is shown propped open. This proved a most convenient arrangement, but the iron showed signs of warping, and next season it is proposed to experiment with "dished" and cone-shaped covers which it is believed will prove more satisfactory. One grower experimenting with this type of furnace reduced the size of the opening to 14 inch square and used an old plough disc fitted with a wire loop by which he lifted it on and off with a stick. The disc proved quite satisfactory, the only drawback to the idea being the rather restricted size of the opening.

An earth ramp may be built up against the front of the furnace on which the fire boy can stand when stoking. In the early stages of curing a small fire can easily be maintained on the lowest portion of the hearth, the upper air inlets being kept closed and one or both the lower ones being left entirely or partly open. As the temperature has to be increased larger logs are added and the other air inlets opened as required. In order to obtain the maximum economy of fuel the cover plate must be kept closed entirely, except when fuel is being added. The logs should be lowered vertically into the furnace, their upper ends being allowed to fall backwards so that they lie in an inclined position on the baffle wall, pointing towards the back of the furnace. The logs should not exceed 4 feet in length, and it will be evident that this furnace is not suitable for burning large stumps or roots.



A NEW TYPE

TOBACCO FURNACE

Scale: 0 1 2 3 Feet.

Irrigation Division.
27-8-34.

Photo Lithographed at the Surveyor General's Office Salisbury S. Rhodesia

The furnace requires very little attention; only the dead ash which collects in the air inlets should be removed from time to time, but care should be taken when doing this not to rake out the unburnt charcoal, as this will eventually be entirely consumed and supply useful heat. At the end of a curing a quantity of dead ash only should remain, and this should be all raked out through the air inlet holes before the next curing is commenced.

As the top of the furnace is flat it is advisable to protect it with a small corrugated iron cover supported on four upright poles, but failing this sheets of iron should be placed on the top of the furnace during the rains.

The results obtained so far have been extremely satisfac- factory. In one instance a furnace of this design consumed only $1\frac{1}{8}$ cords or wood as against $1\frac{1}{4}$ cords consumed by another furnace of orthodox design fitted with fire bars and doors. Other curings of five days' duration have been completed with slightly over one cord of wood.

Gouda or Sweet Milk Cheese.

By F. LAMMAS, District Dairy Officer.

Since the demand for Gouda cheese is steadily increasing and more cheese makers are directing their attention to its manufacture, it is felt that an article dealing with this subject may serve some useful purpose.

The profits to be derived from the manufacture of this cheese are well worthy of the time and energy expended, moreover the process is a short and simple one.

The cheese is ready for sale within a month to six weeks, which provides for a fairly quick turnover of capital.

Gouda is a sweet milk, medium pressed cheese, made from fresh whole milk. In shape it somewhat resembles Cheddar with the sharp edges rounded off, and sloping gently from the centre to the outer surface.

Gouda or sweet milk cheese as the name implies, is made from perfectly fresh milk. The use of acid milk or milk held over from the previous milking will not give satisfactory results, in fact the use of such milk in the warm weather will result in an unsaleable cheese.

Gouda cheese being classed as a medium pressed variety, contains therefore a high percentage of moisture and in consequence its keeping qualities are not so good as those of the hard pressed varieties. In the manufacture of Cheddar cheese, for instance, the process is a lengthy one, usually from 6 hours to 8 hours being allowed from the time the milk is rennetted until the cheese is put to press. During this period any undesirable fermentation which may have been present in the milk usually becomes apparent, and the maker by regulating the amount of acidity from stage to stage in the process, is able to control, or at least hold, in check such fermentation, enabling him to turn out a fairly saleable article. In the manufacture of Gouda cheese, however, the same conditions do not apply. The process is a short, and may almost be

described as a hurried one. Little acidity is developed to counteract or hold in check the actions of undesirable organisms, and the success or failure of the finished article does not so much rest with the skill of the maker as with the quality and purity of the milk. The milk then must be produced under scrupulously clean conditions, and be obtained from cows fed on feeds which will not taint the milk in any way.

Milk rapidly deteriorates upon exposure to impure air or unfavourable weather conditions—even the purest of milk soon becomes sour when kept at high temperatures. It is, therefore, important that the milk should be removed from the cow shed and taken to the dairy as soon as possible after the milking operation has been completed, in this way minimising the risk of contamination by bacterial infection or by absorbed food and other taints.

Cleanliness is the very essence of successful dairying, and this is more than ever true when applied to the manufacture of sweet curd cheese such as Gouda.

Every article coming in contact with the milk or cheese should be thoroughly washed immediately after use in lukewarm water to which a trace of some or other washing compound has been added, then scrubbed with a hard brush in hot water and finally scalded in boiling water.

Equipment.—The requirements for the manufacture of this cheese are few and comparatively inexpensive.

1. Cheese vat.
2. Cheese knives.
3. Cheese press.
4. Cheese moulds (wooden type).
5. Cheese rennet.
6. Cheese colouring.
7. Calico for bandages.
8. Accurate dairy thermometer.
9. Four oz. measuring glass.
10. Cheese starter.
11. Scale.
12. Milk strainer.
13. Dairy salt.

The Starter.—Under the heat conditions prevailing in this Colony it has been found advantageous to use a small quantity of starter. By its addition a limited amount of acidity is developed in the making process which materially assists in checking the actions of gas producing organisms and makes it possible to turn out a uniform article from day to day.

When the cheese is made only during the months of March-July and the milk treated is of exceptionally good quality the addition of a starter may be dispensed with, but, in all events, its restricted use is advisable.

Starters are of two kinds, "Commercial" and "Natural." When cheese is being made on a fairly large scale the use of a commercial starter is recommended.

Commercial Starter.—Commercial starters are preparations consisting of organisms capable of producing lactic acid. They are carefully prepared by specially trained men, and are sold in powdered form in hermetically sealed bottles. Directions for their preparation accompany each bottle.

A satisfactory method for the preparation of this powdered culture is as follows:—

One quart of fresh milk taken under precautionary conditions to ensure cleanliness is placed in a properly cleaned enamel pail. Heat the milk by immersing the pail in a larger vessel containing water to a temperature of 170° F., and hold at this temperature for one hour. Cool down the milk as rapidly as possible by immersing the pail in cold water. Change the water as frequently as necessary and stir the milk periodically until the temperature has been reduced to 70° F. At this stage the contents of the bottle of powdered starter is added and thoroughly stirred in with a previously scalded spoon. The milk should be held constant at this temperature (70° F.) by standing it in cool water. It should be kept in a clean and pure atmosphere, free from taints of any description; furthermore, it should be covered only with a double thickness of muslin.

At the end of 24 hours the milk should have coagulated, when the top layer is carefully skimmed off with a scalded spoon and the remainder thoroughly stirred.

To one half gallon of perfectly fresh clean milk, heated and cooled as already explained, add and stir in thoroughly the quart of coagulated milk. At the end of 24 hours the milk, if kept at a constant temperature of 70° F., should have coagulated and have developed sufficient acidity for cheese making purposes. In this manner a uniform starter may be propagated from day to day by always adding sufficient of the coagulated starter to the amount of previously heated and cooled milk necessary for cheese making on the following day.

Preparation of Natural Starter.—One quart of fresh milk taken under the most sanitary conditions is heated as already mentioned to 170° F. and held at that temperature for one hour. Cool down as rapidly as possible by stirring and immersing the pail in cold water. Change the water as often as necessary until the temperature has been reduced to 70° F. Keep the milk at this temperature by placing the pail in water, cover with a double thickness of muslin and allow to set for 24 hours. At the end of this period skim off and discard the top layer, thoroughly mix the remainder and add it to one half gallon of previously treated and cooled milk. At the end of a further 24 hours the milk should have soured and developed sufficient acidity for use.

By adding sufficient of the coagulated milk to the required amount of heated and cooled milk a uniform starter may be propagated from day to day.

Precautions Necessary.—It should be borne in mind that the quality of the starter is half the success of the making process.

An ideal starter should possess a clean acid smell showing a fine even curd with no separation of whey. A uniform starter giving the satisfactory results intended can only be propagated from day to day when the utmost cleanliness is observed.

The starter will rapidly deteriorate if the utensils coming in contact with it are not thoroughly scalded before and after use. Furthermore it will rapidly absorb a "cheesy" flavour and thus be rendered worthless if stored in the vicinity of the making or curing room. Before adding the starter to the

milk for cheese-making or to the milk intended for the starter on the following day, skim off and discard the top layer. This top layer contains countless particles of dust and harmful bacteria. Always keep the starter covered with a double thickness of muslin.

The starter should be discarded upon signs of gassiness, separation of whey or any undesirable odour. The acidity should be regulated by control of temperature and the amount of coagulated milk added to the fresh milk so that it does not exceed .75 per cent.

Cheese Making Process.—The milk when strained should be cooled as rapidly as possible to 86° F. by stirring and placing cold water in the jacket of the vat. When this temperature is reached the milk is ready for the addition of the starter.

Adding the Starter.—Starter is used in amounts not exceeding one half per cent., except when a small quantity of milk (10 gallons) is being treated, when amounts up to 1 per cent. may be added. Stir the starter well so that the coagulum is broken up and strain the requisite amount through a double thickness of cheese cloth into the vat.

Stir the contents of the vat for 5 minutes so that the starter is evenly distributed, cover the vat and allow to stand for 10 minutes.

Addition of Colour.—The amount to use varies considerably and is dependent upon the season of the year and the market requirements. Usually from 2 ozs. to 2½ ozs. of colouring per 100 gallons of milk will be found sufficient. Cheese colouring may be added direct to the milk or may first be mixed with a little water.

Adding the Rennet.—After the colouring has been well stirred in, standard cheese rennet in the proportion of 5 ozs. per 100 gallons of milk well mixed with eight times its volume of water is added to the milk and thoroughly stirred in for four minutes. After which the surface only of the milk is gently agitated for a further 3 minutes to prevent the fat rising. The vat may then be covered with a clean cloth until the milk has set.

Cutting the Curd.—Under normal conditions the milk should set and be ready for cutting in 35 minutes; indeed, in Gouda cheese making the setting period should be so regulated by the amount of rennet added that the curd is ready for cutting in this time. The curd must be cut at the correct stage, if cut before this an undue loss of fat will occur which will result in a dry and probably unsaleable cheese. The cutting stage is best indicated by inserting the index finger under the surface of the coagulum and gently raising it to the surface. If the curd breaks evenly leaving no particles of curd on the finger, and if the curd in the broken surface shows no signs of milkiness, the curd is ready to be cut.

The object of cutting is to allow the whey to escape and to firm the curd. Thus the finer the curd is cut the greater will be the exposed surfaces and consequently the faster will be the escape of whey, and further as the heating or drying process is a short one the necessity for cutting fine is appreciated. The cutting operation is best done by using the vertical knife first, drawing the knife slowly lengthwise of the vat, then more rapidly crosswise. Then using the horizontal knife cut the curd once again crosswise. This operation will cut the curd into cubes of roughly ½ inch. When during the scalding process the temperature has reached 88° F. or 90° F., a second cut may be made, using the vertical knife, and continuing to cut the curd in all directions until the particles are about the size of small peas.

The curd in the first instance could be cut to the desired size, but owing to the delicacy of the curd when first cut and the abnormal loss of fat which would accompany such a fine cut, it is advisable to postpone the second cutting until the curd has firmed somewhat.

Scalding.—After the curd has been cut and stirred for 5 minutes the temperature should be gradually raised by adding hot water to the jacket of the vat. Stirring should be continued throughout the process of scalding, and preferably by hand, until a temperature of 90° F. has been reached—approximately 20 minutes being taken to increase the temperature to 90° F. (*Note.*—it is at this stage that the second cut is made.) After this heat may be applied more rapidly until the temperature has reached 100° F. The whole of the scalding period should take 40-45 minutes.

It is of the utmost importance that during scalding the temperature should not be allowed to drop. Failing to observe this may result in a cheese containing an excess of moisture with very poor keeping qualities. It will seldom be found necessary to scald above a temperature of 100° F., but if it is found that the curd cannot be firmed sufficiently at this temperature within 15 minutes it may be raised a further 2° or 3°. After the maximum scalding temperature has been reached, the curd is stirred for a further 5 minutes, or until when lifting a portion of curd from the vat it has a smooth, silky appearance, and when pressed together in the hand and suddenly released shows only a slight tendency to stick together.

Removing the Whey.—When the curd has been firmed sufficiently it should be allowed to settle for 5 minutes and the whey drawn off.

Salting.—The most convenient method for salting the curd is the "Brine System," and is as simple as it is effective.

Method.—When the whey is escaping a small amount should be caught in an enamel pail—sufficient only to dissolve the required amount of salt. Usually 6 lbs. of salt per 100 gallons of milk originally in the vat will give the desired results.

When removing the whey, sufficient should be left in the vat to just float the curd, and at this stage the mixture of salt and whey is poured back into the vat. Twenty to twenty-five minutes should be allowed for the curd to soak and to absorb the required amount of salt.

Care should be taken during the soaking period not to allow the temperature to drop below 100° F. It should also be noted that salt has a hardening effect upon the curd. A little experience will enable the maker to draw the whey a few moments before the desired firmness has been attained, thus allowing for the affects of the brine.

Moulding the Curd.—To prevent undue chill to the curd the moulds should be previously scrubbed and placed in hot water. This will to a great extent prevent the defect of cracked rinds. The curd may now be placed in the mould in thin layers, each layer being pressed by hand to assist the

escape of whey. Fill each mould to about three-quarters of an inch above the rim. Pressure by hand is continued for a minute or two and the cheese inverted in the mould three or four times.

When a sufficient whey has been expelled by gentle hand pressure, a square of thin calico is spread evenly over the wooden mould lid, the cheese is placed on top of this and the calico neatly wrapped around the cheese.

The cheese is then quickly placed back in the mould, the calico so adjusted with the corners and edges tucked in the sides, thus forming no sharp edges and when under pressure allowing no escape of curd.

Pressure.—When the calico has been adjusted the wooden lid may be placed in position and light pressure applied. At the commencement the pressure should not exceed 1 lb. weight per pound of cheese in the mould. This may gradually be increased until the maximum weight is applied, *i.e.*, 10-12 lbs. per lb. cheese in the mould. After being under pressure for one hour the cheese is removed from the mould, wrapped in a clean bandage reversed and placed back in the mould. Pressure is applied for a further 2 hours, the bandage is again changed, the cheese reversed in the mould and put under the pressure for a further 12 hours, or until the following morning. At the end of this period the bandage is removed and is not again replaced. The cheese is rubbed over lightly with a sprinkling of salt which assists in forming a tough rind.

The cheese is then reversed and replaced in the mould (which has been thoroughly washed and scalded and subjected to a very slight pressure in order that the cheese may acquire the desired Gouda shape.

The shaping process as a rule takes 12 to 15 hours, during which time the cheese is reversed several times in the mould.

Curing.—After removal from the moulds the cheese should be wiped with a clean damp cloth and placed in a room set aside exclusively for curing purposes. During the first 10-12 days it is advisable to turn each cheese twice daily and to keep the surfaces dry. When the cheese is about 10-12 days

old it may be oiled with boiled linseed oil. This has the effect of sealing the pores and preventing the cheese from drying out excessively.

Moisture on the surface of cheese or on the shelf upon which the cheese rests is very apt to cause cracked rinds, a condition favourable for the entry of mould. The temperature in the curing room is a most important factor, and unless precautions are taken to keep this room cool the result will be disastrous.

High temperatures are very favourable for the growth of "gas" producing organisms which cause cheese to "blow" and render it unfit for sale. Further, high temperatures causes cheese to "sweat" with a consequent loss of fat. Such a cheese will have a dry inferior body, apart from an impaired flavour.

The curing room should be constructed of insulated or extra thick walls. The roof, if of corrugated iron, should be covered with thick covering of thatch, leaving a 2 inch air space between the iron and thatch, and so constructed that the roof is carried well down to act as a shade for the walls.

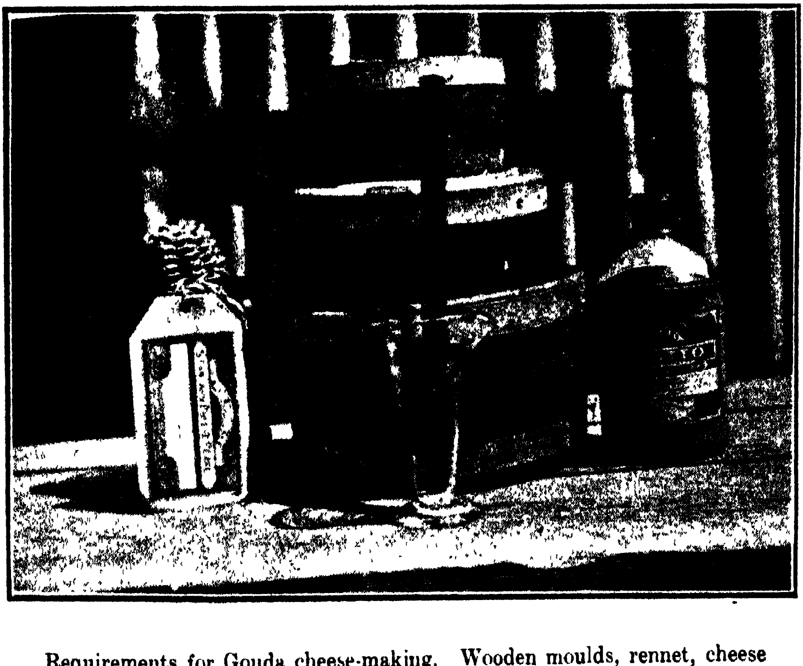
A ceiling in both the making and curing rooms is considered essential. Ventilation is also of considerable importance, and in this connection it should be mentioned that Gouda cheese should not be exposed to draughts, as surface cracks are often caused by cold or cool winds.

The windows—each provided with a tight-fitting wooden shutter—should be placed fairly high in the walls, and when opened during the evenings should be covered with some light material which will break the current of the air.

The cheese shelves should be below the level of the window sills, and be so arranged that they may be easily removed for cleaning purposes.

Certain markets require a cheese coloured on the outside. Raspberry red, a special powdered preparation sold by most chemists, serves the purposes very well. It is mixed with cold water to the desired strength and painted on the rind. If the cheese is to be oiled the colouring should be done first and allowed to dry thoroughly.

Filling the mould. The curd is pressed with the flat hands until it is ¾ to 1 inch above the rim.



Requirements for Gouda cheese-making. Wooden moulds, rennet, cheese colour, thermometer.

Defects.—The most common defect in Southern Rhodesia is "gassiness." In Gouda cheese the organisms responsible for this characteristic are most active during the months of November, December, January and February. As previously mentioned, the cheese maker has little or no control over these organisms during the making process, and the only real safeguard is to pay particular and individual attention to cleanliness in the production of the milk.

Much can be done to check or overcome gassiness by the use of a pure starter and by keeping the temperature in the curing room as near 60° F. as possible. If gassiness persists in spite of every precaution the use of saltpetre in amounts not exceeding 4 ozs. per 100 gallons milk may be resorted to. The saltpetre should be added to the milk before the starter is added, but may also be added to the whey immediately after the curd is cut.

Cracked Rinds.—Cracked rinds are usually caused by the cheese being exposed to draughts, allowing the cheese to remain in contact with wet surfaces or failing to rub with salt immediately after being removed from the press. The defect is also prone to occur if the curd is allowed to cool on the surface when moulding. The remedy is to avoid sudden chills and draughts and to keep the surfaces of the cheese and the shelving dry.

This defect may also be caused by bandaging the cheese carelessly, *i.e.*, by tucking the edges in so that a ridge is formed, or failing to cut the sharp edges and waste portions away when removing from the press.

Bitter Flavour.—This is usually caused by the use of excessive amount of starter or by retaining too much moisture in the finished cheese.

Remedy.—The obvious remedy is to use the correct amount of starter. To avoid retaining too much moisture firm the curd a little more before drawing whey, and be careful not to allow the temperature to drop during the scalding or salting period.

Sour Flavour.—This is also caused by an excess amount of moisture and is easily remedied by firming the curd a little more before drawing whey.

Solid Body.—This defect is usually caused by subjecting the curd to too much pressure. The maximum pressure should not exceed 15 lbs. weight per 1 lb. cheese.

Mould Growth.—Gouda cheese is very liable to mould contamination. Every effort should be made to keep down the infection by washing the cheese periodically with a weak solution of formalin or lime water. A typical Gouda cheese record is given hereunder. It is merely given as a guide and is in no way intended as a definite rule of thumb from which no departure may be tolerated. Indeed, it may often be found necessary to alter the process considerably. It will be noticed that the acidity is given at the various stages of the process, and although not strictly necessary when handling perfectly normal milk, and more especially when only small quantities are being treated, it should be emphasised that the determination of the acidity is strongly advocated, and for this reason particulars for carrying out the test are given.

TEST FOR ACIDITY IN MILK, CREAM AND WHEY.

The apparatus required for this test is a burette graduated in cubic centimetres and 1-10th cubic centimetres; a 9 cubic centimetre pipette, a small quantity of Phenolphthalein as an indicator and a supply of tenth normal caustic soda solution.

It is advisable to have the caustic soda solution prepared by a reliable chemist, as it is upon this solution that the accuracy of the test depends. The Phenolphthalein may be procured from the same source.

The Test.—9 cubic centimetres of the milk or whey to be tested are discharged into a tea cup and two or three drops of Phenolphthalein added. Sufficient soda solution is then run from the burette into the milk or whey to change its colour to a permanent pale pink. When this colour is obtained the acid present has been completely neutralised and the amount of caustic soda required to bring about this change indicates the percentage acidity.

Value of Readings.—3 $^{2}/_{10}$ ccs. reading on the burette indicates .32% acidity.

2 $^{5}/_{10}$ ccs. reading on the burette indicates .25% acidity.

5 ccs. reading on the burette indicates .5% acidity.

Time milk received at Dairy	9.50 a.m.
Gallons milk in vat	100 gallons.
Acidity of milk	.19%
Temperature of milk	86° F.
Quantity of starter added	5 lbs. (½ gallon)
Time starter added	10.00 a.m.
Quantity colouring added	2½ ozs.
Quantity rennet added	5 ozs.
Time rennet added	10.20 a.m.
Time cut	10.55 a.m.
Acidity immediately after cutting...	.135%.
Time heating commenced	11.00 a.m.
Cut again (second cut)	11.20 a.m.
Heating stopped	11.40 a.m.
Temperature of scald...	101° F.
Quantity salt added	6 lbs.
Time salt added	12.00 p.m.
Time allowed to soak	20 minutes.
Commenced moulding	12.20 p.m.

SUMMARY.

1. Only the best possible milk should be used. Holding milk over from the previous milking will prove disastrous.

2. When the milk is cooled to 86° F. add the carefully prepared "Starter" in amounts not exceeding ½ per cent. The starter should be strained into the vat.

3. Colouring is next added in the proportion of 2 ozs. per 100 gallons milk, *i.e.*, 1 dram to each 12 gallons of milk.

4. Rennet is next added in the proportion of 5ozs. per 100 gallons of milk. The rennet is diluted with water and thoroughly stirred in the milk for 4 minutes.

5. When the curd has set it should be cut first with the vertical and then the horizontal knife.

6. Stirring the curd for 5 minutes before heat is applied is essential.

7. Stirring should continue during the whole of the scalding period, 15 minutes being taken to increase the temperature to 90° F. (when the second cutting is done), and more rapidly from 90°—100°.

8. When the curd is firm enough to show only a slight tendency to stick together the curd should be allowed to settle to the bottom of the vat and the whey drained off.

9. Sufficient whey should be left in the vat to float the curd; at this stage salt is added in the proportion of 6 lbs. salt per 100 gallons milk originally in the vat.

10. Twenty minutes is usually sufficient time for the curd to absorb the requisite amount of salt.

11. The curd is then placed in the cheese mould, which should be filled about $\frac{3}{4}$ inch above the rim. After pressing the curd down firmly it is reversed and replaced in the mould wrapped in a calico bandage and placed under slight pressure for 1 hour.

12. After one hour's pressure the cheese is removed from the press, re-bandaged and returned to the press.

13. At the end of this period the cheese is again re-bandaged and put back to press for a further 12 hours.

14. When sufficient pressure has been applied the bandage should be removed from the cheese and the cheese placed back in the mould to shape. This process usually takes 12 hours and it is necessary to reverse the cheese continuously.

15. The cheese may then be removed from the press, rubbed over lightly with salt and placed on a clean dry shelf in the curing room.

16. During the first 10-12 days each cheese should be turned twice daily and kept dry.

17. Usually the cheese is ready for consumption in from 4 to 8 weeks, depending upon the size. The smaller the cheese the less time is required for ripening.

A Cheap Portable Colony House
FOR POULTRY.

By G. H. Cooper, Poultry Officer,
Matopo School of Agriculture and Experiment Station.

The Colony House now described has been made and tested out at the Matopo School of Agriculture, proving very serviceable, practical and cheap, the total cost of material being only 10s. to 12s. It is primarily intended for young stock, either pullets or cockerels on free range, but may also be used in a wire-netting enclosure. With the addition of perches it may be used for a few mature stock such as a breeding pen or old breeding males on range.

Construction.—Take two sheets of corrugated galvanised iron 10 feet x 2 feet. Bend each sheet at right angles in the middle at the 5 foot mark. To do this tap the centre line lightly with a cold chisel and hammer to dent it, but not cut through Place one end upon a box, step on the other end and advance towards the centre line, the iron will bend in a straight line where dented and may then be pulled into a right angled bend with the hands.

Again 1 foot 6 inches from each end bend each sheet as described previously to an angle of approximately 135 degrees.

Place the two sheets together, allowing one corrugation of one sheet to overlap one corrugation of the other sheet in a similar fashion as when using iron for roofing. Fasten the two sheets together with a few gutter bolts where the one overlaps the other to form one unit.

With the ends of the sheets on the ground the structure now has the appearance of a small building with two upright sides and a pointed roof. It is 5 feet wide across the open ends at the bottom, 4 feet deep, being the width of the two sheets of iron, and 4 feet high at the apex.

Next construct a rectangular framework 5 feet x 4 feet of 2 inch x 2 inch timber, or straight 2 inch diameter gum-poles if available. The two pieces of timber used for the 4 teet sides should be cut 6 feet in length and allowed to project beyond the framework 1 foot at each end. Along the 4 feet sides two pieces of No. 10 plain galvanised wire are looped across the framework, 16 inches apart, and each twisted to tension. Similarly across the 5 feet sides three wires are twisted to tension 15 inches apart. Where these wires cross in six places they are held together by means of baling wire. These cross wires keep the framework securely together and serve as supports for the floor of wire netting and the weight of the birds. If the timber used has a tendency to bend inwards it will be necessary to include two pieces of similar timber in the form of a cross in the middle of the framework, in which case the centre wire between the two 5 feet sides can be dispensed with. Over this rectangular framework attach ½ inch mesh wire netting stretched tight to form the floor of the house.

Place the floor thus constructed into the corrugated iron structure with the four 1 foot timber projections at each corner to the open front and back of the house. The 5 feet sides of the floor will be in a line with the edges of the iron structure both front and back. Raise the floor 6 inches from the ground level and fasten into position by means of screws with washers through the corrugated iron sides. The 1 foot timber projections at each corner serve as handles for transporting the house.

Along each edge of the corrugated iron sides both front and back from floor level to the apex attach pieces of 1 inch x 1 inch timber by means of screws through the iron.

Cut ½ inch mesh wire netting to fit the open front and back and attach one piece to one end by means of staples in the floor framework and the light timber around the edge of the iron. This end, which will be the back of the house, may now be thatched over the wire netting to within 9 inches of the apex; or if desired the netting may be dispensed with and flat or corrugated iron attached instead, leaving a small triangular opening at the apex 9 inches deep for ventilation

purposes. This triangular opening must be covered with ½ inch mesh wire netting to prevent chickens getting out or vermin getting in.

On the front two pieces of light plank such as 3 inch ceiling board are nailed to the floor framework and the timber on the sloping sides near the top 18 inches apart to form a doorway in the centre. The open spaces on either side and above the doorway are covered with ½ inch wire mesh netting.

A light door is made to fit the gateway, covered with the netting and fastened in position with hinges and fastener. Butt hinges similar to those purchased can easily be made from odd pieces of flat galvanised iron and a wire nail.

The open spaces 6 inches deep in the front and back between the floor and ground level are closed by nailing strips of flat galvanised iron to the floor framework. This is necessary to prevent vermin from getting at the legs and feet of the birds from underneath the netting floor.

Uses.—The Colony House is now complete and will hold 20 mature light breed pullets or 50 at two months of age. It is all that is required in the way of housing during the time of year when pullets are growing. Pullets should be introduced to these houses at about two months of age and may remain in them until they begin to redden up, when they are shifted to permanent laying quarters.

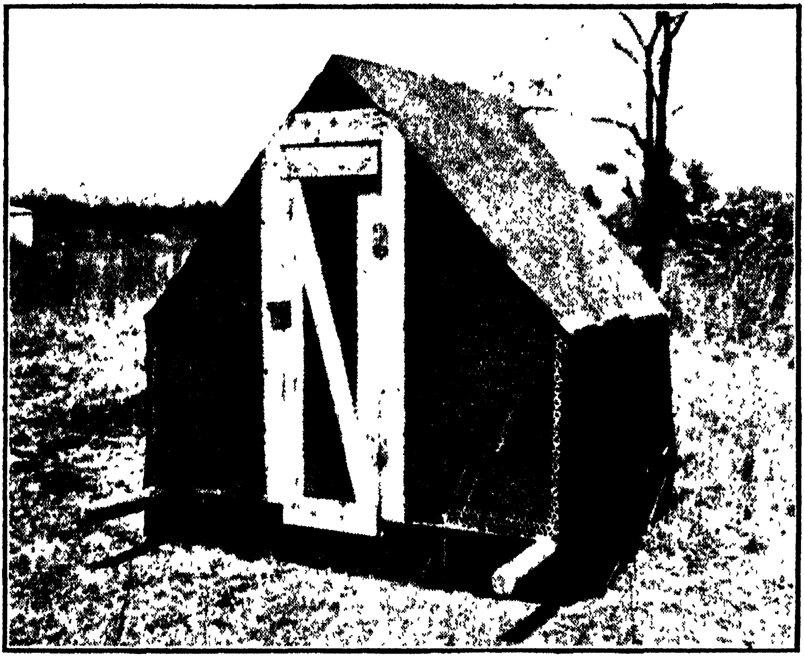
If mature birds are kept in this type of house three perches of 2 inch diameter timber should be placed across the house 4 inches above the floor and fastened in position by means of screws through the iron sides into the ends of the perches or by means of some arrangement whereby the perches can easily be removed if necessary.

All droppings from the birds pass through the netting floor and so cleaning is only necessary occasionally. The birds cannot get at the droppings and they may be collected. These houses are portable and best used on free range, when they should be shifted around occasionally and placed about 30 yards apart for the best results.

No timber is in contact with the ground, so the house is proof against termites.

Use the outdoor feeder described in a previous article with this type of house, both of which may be constructed easily and very cheaply on the farm.

Cement Paint.—If it is desired to use old iron in the construction of these houses it will be very beneficial to give the iron two coats of cement paint when constructed, this will effectively block up small holes and preserve the iron for many years if in fair condition. It is made as follows:—Equal parts of raw linseed oil, paraffin, cement and red oxide are taken, well mixed and allowed to stand for 12 hours. Stir thoroughly and pour through a wire sieve. Apply with a brush, stirring occasionally. Six cups of each ingredient will make one gallon of this paint.



LOCUST POISON.

Directions for Use.

1934-35 CAMPAIGN.

The following directions for the use of locust poison are presented in an abbreviated and readily available form:—

Arsenite of soda powder, which is now being imported for the purpose of locust destruction, has advantages over the concentrated solution previously used, particularly in respect to the cost of transport and containers.

Owing to its fine state of division, it enters readily into solution in water. It is only necessary to throw the measured quantity into the vessel and to stir the water thoroughly.

The powder consists of arsenite of soda containing 80 per cent. of arsenious oxide. For spraying purposes 3½ ounces (by weight) are dissolved in a 4-gallon petrol tin of water.

The Government supplies tin measures giving the quantity of poison to be dissolved in a four gallon tin of water. The capacity of the measure is about 1¾ fluid ounces, 50 c.c. or 3½ level tablespoons.

On no account should the solution be used at a greater strength than is directed above. It is not only wasteful of poison, but increases the danger of poisoning livestock.

In connection with the above, it is to be emphasised that in measuring with a tablespoon or other measure, the powder must be *level with the top and not heaped*. It should be noted that tablespoons vary in size, and the standard measures mentioned above should be used when possible.

Spraying.—The solution is sprayed lightly over and around the resting hoppers in the evenings and early morning, or at night, or sprayed lightly over the grass in front

of slowly moving swarms of hoppers which are feeding during the day on the march. It is not necessary to *drench* either the hoppers or the herbage. Such a proceeding is both wasteful and dangerous to stock.

SPRAY LIGHTLY.

During the heat of the day hoppers frequently move rapidly in open formation and do not feed. Under these conditions effective spraying is difficult.

Sprayed locusts do not die immediately. Substantial results may be looked for next day. The full effect may not be apparent for several days. If the hoppers die in large numbers within a few hours it is a sign that the solution used was too strong.

Sprayed locusts may continue to feed for a short time after being sprayed, but cease to feed long before death occurs.

Arsenical cattle dip can be used in an emergency as a good substitute for the official locust poison. A dip intended to be used at one part in 400 for dipping cattle should be diluted to one part of the concentrated dip in 160 parts of water for spraying hoppers.

Care of Pumps.—For the best results, pumps should be kept in good repair. Particular attention should be given to the replacement of the gland packing and the packing on the plunger. Plenty of grease should be used. Spare packing can be obtained from Magistrates, Native Commissioners, etc.

Baiting.—On cultivated lands baiting may be resorted to under favourable, dry conditions. Three or more ounces of sodium arsenite are dissolved in four gallons of water and the solution is used to moisten a carrier such as bran, maize, or ground maize cobs. This bait should be spread thinly in front of feeding hoppers on the march or among resting ones.

Danger to Stock and Humans.—Arsenite of Soda has a slightly saline taste, which is apparently agreeable to grazing animals, and they will sometimes lick the powder up like salt. Obvious precautions must be taken in this connection. Stock should also not be allowed access to poisoned areas until after a washing shower of rain has fallen, or until the grass has

dried and has been burned. Vessels used for poison should have a red band painted around them as a warning. Hands, etc., should be washed by pouring water over them rather than by dipping them. Operators should wash hands and legs frequently to avoid caustic burning. Fat or grease should be rubbed on the arms and legs of operators. Common-sense methods should be used to avoid accidents.

ANTIDOTES FOR ARSENICAL POISONING.

In the case of human beings that get poisoned from arsenic, an emetic should be given at once and medical assistance summoned immediately. In the meantime, as soon as the stomach has been emptied by vomiting, iron or magnesia preparations may be given if available, followed by liberal quantities of milk or water.

Collapse should be treated by the ordinary measures, using warmth and stimulants.

Cattle poisoned with arsenic should be dosed with oil or equal parts of oil and lime water and should be kept warm.

A useful emergency remedy in arsenical poisoning is freshly precipitated iron hydrate, which may be prepared by adding magnesia to a solution of iron sulphate. Magnesia alone, shaken up with water, may also be given and is claimed to be efficacious in preventing gastric inflammation.

Southern Rhodesia Veterinary Report.

SEPTEMBER, 1934.

AFRICAN COAST FEVER.

Charter District.—The mortality at the Greyling centre was 62 and 18 at Riversdale centre.

FOOT AND MOUTH DISEASE.

Only two slight extensions occurred on the south-eastern portion of the Colony adjoining the Nuanetsi concentrated herds.

TRYPANOSOMIASIS.

Five cases in Hartley District and one in Melsetter District.

TUBERCULIN TEST.

Seventeen head of cattle were tested on importation with no reaction.

MALLEIN TEST.

Twenty-one horses were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa:—Cows 5, heifers 1, bulls 11, horses 21, sheep 417, pigs 9.

EXPORTATIONS.

To the United Kingdom *via* Union Ports in Cold Storage—Chilled: Beef quarters, 5,626. Frozen: Beef boned quarters, 2,570; veal boned quarters, 372; beef boned, 33,488 lbs.; tongues, 10,484 lbs.; livers, 10,345 lbs.; hearts, 4,666 lbs.; tails, 2,340 lbs.; skirts, 3,615 lbs.; shanks, 7,990 lbs.; kidneys, 315 lbs.

Meat products from Liebig's Factory:—Meat meal, 81,000 lbs.; corned beef, 36 lbs.; beef fat, 168,940 lbs.; tongues, 6,696 lbs.; bone meal, 74,000 lbs.; meat extract, 58,420 lbs.; beef powder, 64,741 lbs.; hoofs, 28,500 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 23. October, 1934.

The locust position during October has become increasingly menacing, swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) having been reported from all parts of the Colony. Many of the reports refer to swarms of very large size. Towards the end of the month large swarms invaded the Colony from Northern Rhodesia flying southward.

Swarms have continued to haunt the region of the Eastern Border, where they have constituted a serious threat to early crops and grazing, as well as to plantations, and have appreciably influenced farming operations.

The direction of flight within the Colony to the end of the month has shown no definite trend. There has as yet been no indication of a southward pre-breeding migration from the Colony.

Ovaries are now developing in the females, whilst the males appear sexually to be almost fully developed, and in some parts are beginning to change colour. From the behaviour of the insects on the Eastern Border it appears possible that the swarms at present infesting that region may remain to lay. Apart from the larger and denser swarms, the locusts here are scattered over a wide area, flying aimlessly about. The males in this region are definitely changing colour.

Enemies and Diseases.—No records. All specimens examined have appeared to be quite healthy, and there have been no reports of avian or other enemies concentrating on the swarms.

Damage.—Some damage to citrus plantations, early maize and grazing has been reported from various parts of the Colony.

Preparation for Anticipated Hopper Campaign.—Preparations are well forward for the anticipated campaign against hoppers. All pumps have been overhauled and further supplies are on order for early delivery. A supply of arsenite of soda powder equal to that used during the least season's campaign has already been provided and further supplies can be obtained if necessary.

RUPERT W. JACK,
Chief Entomologist.

SALES.

Agricultural Experiment Station, Salisbury

Spineless Catcus Slabs (blades) Algerian variety, per 100 Slabs 7/6 delivered at the Salisbury Experiment Station, or 10/- delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Kudzu Vine Crowns, per 100 Crown 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns during November and December.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbury.

Southern Rhodesia Weather Bureau.

OCTOBER, 1934.

Pressure.—The mean barometric pressure over the country was approximately normal.

Temperature.—Mean temperature for the month was also also approximately normal.

Rainfall.—The usual October showers were recorded over the greater part of the country.

OCTOBER 1934.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max	Min.	½ Max Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch	...	...	104	51	89.3	65.4	77.3	76.9	75.2	63.7	53	57	...	1.59	0.86	4	...
Beit Bridge	964.7	...	108	51	96.2	65.0	78.8	...	76.9	64.0	50	52	2.5	0.00	1.15	0	1,500
Bindura	892.2	...	96	44	86.6	61.8	74.2	...	73.1	60.2	47	52	1.4	1.64	0.60	2	3,700
Bulawayo	869.0	869.2	97	44	85.6	58.6	72.1	72.3	72.0	57.3	42	46	2.5	0.00	0.82	0	4,426
Chipinga	893.3	...	97	47	81.2	57.5	69.3	...	71.5	59.8	53	53	2.0	2.35	1.48	4	3,685
Enkeldoorn	858.6	...	94	45	81.9	56.3	69.1	71.3	69.1	58.1	54	50	1.8	1.64	1.27	5	4,788
Fort Victoria	896.2	896.1	100	45	85.4	58.5	71.9	71.1	72.7	59.8	47	50	2.5	1.27	0.95	4	3,571
Gwaai Siding	903.7	...	102	45	94.7	60.5	77.6	..	76.3	60.5	42	50	1.5	0.00	0.69	0	3,278
Gwanda	906.5	...	101	46	88.0	61.8	74.9	...	73.8	59.4	45	49	2.5	0.14	0.93	4	3,229
Gwelo	863.0	...	96	44	83.9	57.5	70.7	72.5	70.4	57.6	48	48	2.1	1.52	0.74	3	4,628
Hartley	885.5	...	97	44	88.5	58.1	73.3	75.0	73.1	59.0	44	48	1.5	3.22	1.11	4	3,879
Inyanga	837.5	...	87	39	77.3	54.5	65.9	...	69.4	57.4	48	48	...	1.55	1.17	6	5,514
Marandellas	838.3	...	88	44	78.8	55.4	67.1	...	67.4	55.4	48	42	1.2	2.36	1.36	4	5,452
Miami	879.5	...	94	52	85.3	60.1	72.7	.	73.9	59.5	43	49	1.6	0.66	0.21	4	4,078
Mount Darwin	907.9	...	97	47	89.2	62.0	75.6	..	76.2	63.9	51	56	1.7	0.44	0.42	3	3,180
Mount Nuza	803.1	...	81	40	68.2	50.9	59.6	...	60.0	51.5	57	44	3.4	1.06	...	5	6,668
Mtoko	878.2	...	94	49	85.1	61.3	73.2	...	73.8	...	...	..	1.1	0.03	0.77	2	4,140
New Year's Gift	...	...	103	49	87.8	59.1	73.4	...	73.2	61.8	52	54	...	1.69	1.17	3	2,690
Nuanetsi	962.5	...	108	45	91.9	60.9	76.4	...	77.9	64.7	52	58	2.6	0.20	0.65	1	1,580
Plumtree	864.7	...	96	44	86.9	61.5	74.2	..	73.2	57.3	38	43	1.2	0.08	0.74	2	4,549
Que Que	882.4	...	97	49	87.3	59.7	73.5	...	72.0	57.7	42	47	1.5	0.31	0.91	3	3,999
Rusape	863.0	...	94	36	80.9	54.6	67.8	.	68.9	56.7	48	47	1.5	2.00	0.71	3	4,647
Salisbury	855.4	855.4	92	49	82.5	57.6	70.1	71.0	70.8	57.3	45	47	1.5	1.67	1.11	5	4,885
Shabani	908.0	...	101	48	87.8	63.5	75.7	...	73.7	60.9	50	53	2.7	0.30	0.87	3	3,193
Sinoia	888.3	...	97	43	87.7	57.2	72.4	...	74.6	61.0	46	52	..	1.79	0.80	3	3,794
Sipililo	885.6	...	94	50	85.5	63.1	74.3	...	73.8	58.9	41	48	1.4	0.46	0.54	2	3,876
Stapleford	843.0	...	88	31	74.8	49.6	62.2	...	65.6	55.5	55	48	3.4	0.93	2.12	6	5,290
Umtali	893.7	894.1	99	43	85.0	58.9	71.9	70.9	71.7	56.9	51	52	2.9	1.91	1.13	3	3,672
Victoria Falls	...	...	104	50	96.8	61.2	79.0	...	78.3	61.2	37	50	0.6	1.26	0.64	2	2,990
Wankie	926.0	...	105	55	96.8	70.9	83.9	..	81.9	61.1	30	46	1.2	0.04	0.30	2	2,567

Farming Calendar.

DECEMBER.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished

CITRUS FRUITS.

This is a good month to plant citrus trees in their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work

should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken. as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk-borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable green stuff dipped in arsenate of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grasshoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borers. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by

mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder- 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Officer,

Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning. and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 pm., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

JANUARY.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible. examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once. such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done. push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol use at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanimycus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant. or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to

employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Warm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, August, 1933.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning wih a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.)—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in

the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leat-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit:—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2¼ lbs.; water. 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring. owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon a they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground. thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran and give about one desert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard. mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and "rotate" the grazing as much as possible. Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, *i.e.*, a cow producing three gallons of milk should receive 6 to 7 lbs. of

concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

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Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep wili also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deacan Hemp (Hibiscus Cannabinuc) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.

No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwtring, Agriculturist.

6o. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

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